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The Steamboat "Puritan."

Our illustrations on this, and on page 2 represent the deck plans and a longitudinal view of the "Puritan," which is now rapidly nearing completion, and will be the latest addition to the Fall River line of steamers. Many new features in steamboat accommodations have been introduced, and these, no doubt, will be appreciated by the traveling public.

Length of steamer over all	420 ft.
Width	91 "
Length of hull on water line	404 "
Width	52 "
Depth from base line to top of deck beams, amidships	21 ft. 4 in.
Whole depth from base line to top of house over engine	70 "
Draft, loaded	13 "
Displacement	4,775 tons.

The hull is made of steel; it is a double one, and is constructed so as to form, with the longitudinals, fifty-two water-tight compartments. Besides these, there are seven water-tight bulkheads running athwartship.

The main engine is a compound, vertical, beam, surface-condensing engine. High-pressure cylinder is 75 inches diameter, 9 feet stroke; low-pressure cylinder 110 inches diameter, 14 feet stroke. Engine frames are made of steel.

The engines are designed and constructed for a working pressure of 110 pounds of steam on the high-pressure cylinder, and to develop 7,500 indicated horse-power.

Pistons are of cast-iron, box form, well ribbed, and with narrow follower ring.

Cylinder covers are also of the box form, well ribbed and finished top. Low-pressure cover is provided with manhole. Stuffing-boxes packed with metallic packing.

Cylinder bottoms are cast separate from cylinders, and made to correspond therewith, having nozzles for lower steam chest of the same dimensions as those on cylinders.

The condenser extends under both cylinders, and serves as a bed-plate. The seamless brass tubes in condenser are ¾ inches o. d. tinned inside and outside, and give a total cooling surface of 15,000 square feet. Tube heads are made of brass. The condenser has two inlets and outlets for condensing water, and is provided with two centrifugal circulating pumps of ample capacity, with independent engines. It is also so arranged and furnished with pipes, valves and connections, that it can be used when desired as a jet condenser.

Air pump is made of cast-iron, 1¼ inch thick in thinnest place; it is lined with brass, ⅜ of an inch thick, bored 62 inches diameter; stroke, 5 feet; a brass ring on top of bore receives the floating top. The bucket is made of brass, and the valves of rubber. Reservoir of cast-iron, bolted to the air pump, 8 feet 4 inches diameter, and 6 feet high above top of air pump.

There are two feed pumps, one on each side of air pump, coming inside of reservoir. Barrels are of brass, plungers, 9½ inches diameter. Chambers of cast-iron, fitted with brass seats. Rods connect to air pump cross-head.

Low-pressure steam chests are made in the usual manner, with balance poppet-valves. Valves of cast-iron, 25¾ and 26½ inches diameter. Steel valve stems 2¾ inches diameter, and covered with brass in the stuffing-box part. Steam port opening in this chest is 14½ by 63 inches.

In the high-pressure steam chests the valves are 16 and 15¼ inches diameter. Steel valve stem, 2¼ inches diameter. Steam port opening is 8½ by 40 inches. Side pipes for low-pressure cylinder, 33½ inches diameter; for high-pressure cylinder, 21 inches diameter.

Beam and shaft pillow blocks are made of cast-iron, with wrought-iron binders. Beam binder bolts, 9½ inches diameter outside of thread, and shaft binder bolts, 7½ inches diameter outside of thread. Main journals on shaft, 27 inches diameter by 30 inches long; gangway, 27 inches diameter inboard to 30 inches diameter at gunwale; gunwale bearing, 30 inches diameter by 54 inches long; wrought-iron connecting rod, 38½ feet long; upper neck, 12 inches diameter; lower neck, 14 inches diameter; center, 18 inches diameter. Crank-pin, 19 inches diameter by 22 inches long. Walking-beam, 34 feet long from center to center of outer pins, and 17 feet wide.

Journals on main beam center, diam.	19 x22
" of L. P. end center, "	11½x11½
" of H. P. " " "	10½x10½
" of connecting-rod center	12 x12

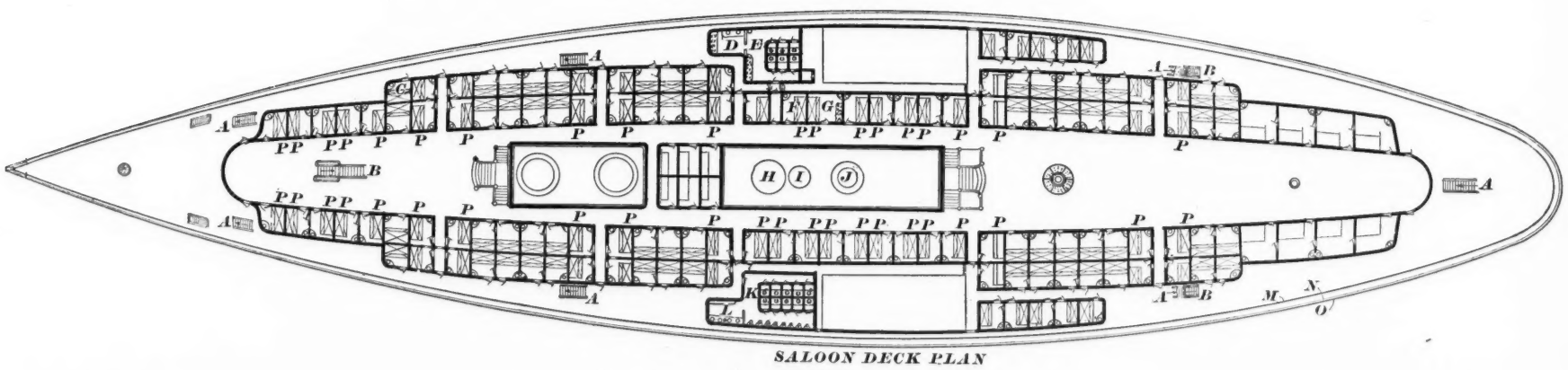
Piston rods of wrought-iron; low-pressure rod, 12 inches diameter; high-pressure rod, 11 inches diameter. Air pump rod, of best forged iron, 4¾ inches diameter, cased with brass 1/16 inch thick.

The boilers are the Redfield type; eight of these are used, and are made of steel. Total grate surface, 850 square feet; heating surface, 25,500 square feet. Feathering side wheels, 35 feet diameter outside of buckets. Each wheel has thirteen buckets, 14 feet long, 5 feet wide, and ⅜ inch thick; they are made of steel.

On stepping on the main deck the passengers enter a handsome social hall, which is situated aft of the engines. This social hall is 58x24 feet; from this the grand staircase leads up to the saloon deck. Aft of the social hall on the main deck there are two handsomely furnished cabins for ladies. The one furthest aft is the ladies' private cabin; its floor space is 42 feet long, and greatest width about 24 feet. State rooms are arranged along the sides of this cabin; O_2, P_2 are the toilet rooms; and N_2 a stairway leading into the dining room below. Along the sides of the other ladies' cabin there are arranged double rows of staterooms. The length of floor space in this cabin is 74 feet; greatest width about 27 feet. The rooms J_2, K_2 forward of the staterooms are for the clerks; M_2 is the steward's room; and L_2, for the stewardess. I_2 is the barber shop; H_2, ticket office; G_2, captain's office, and B_2, coat and baggage room.

In the engine enclosure, U represents the engine room; X_2 low pressure, and Y_2 the high pressure cylinders; V_2, center line of shafts; A_2, feathering wheels; X, duplex pump 18½x12x14 inches; Y, another duplex pump, 14x8½x12 inches; and Z_2, simply a work bench in the pump room. V is the mate's room, and W, lamp room; W_2, refrigerators; F_2, storeroom; and D_2, mess room. In the boiler enclosure, T is the donkey boiler room; and R, superheaters. The various rooms forward of the main deck are principally for the use of the crew. On

THE STEAMBOAT "PURITAN."



SALOON DECK PLAN

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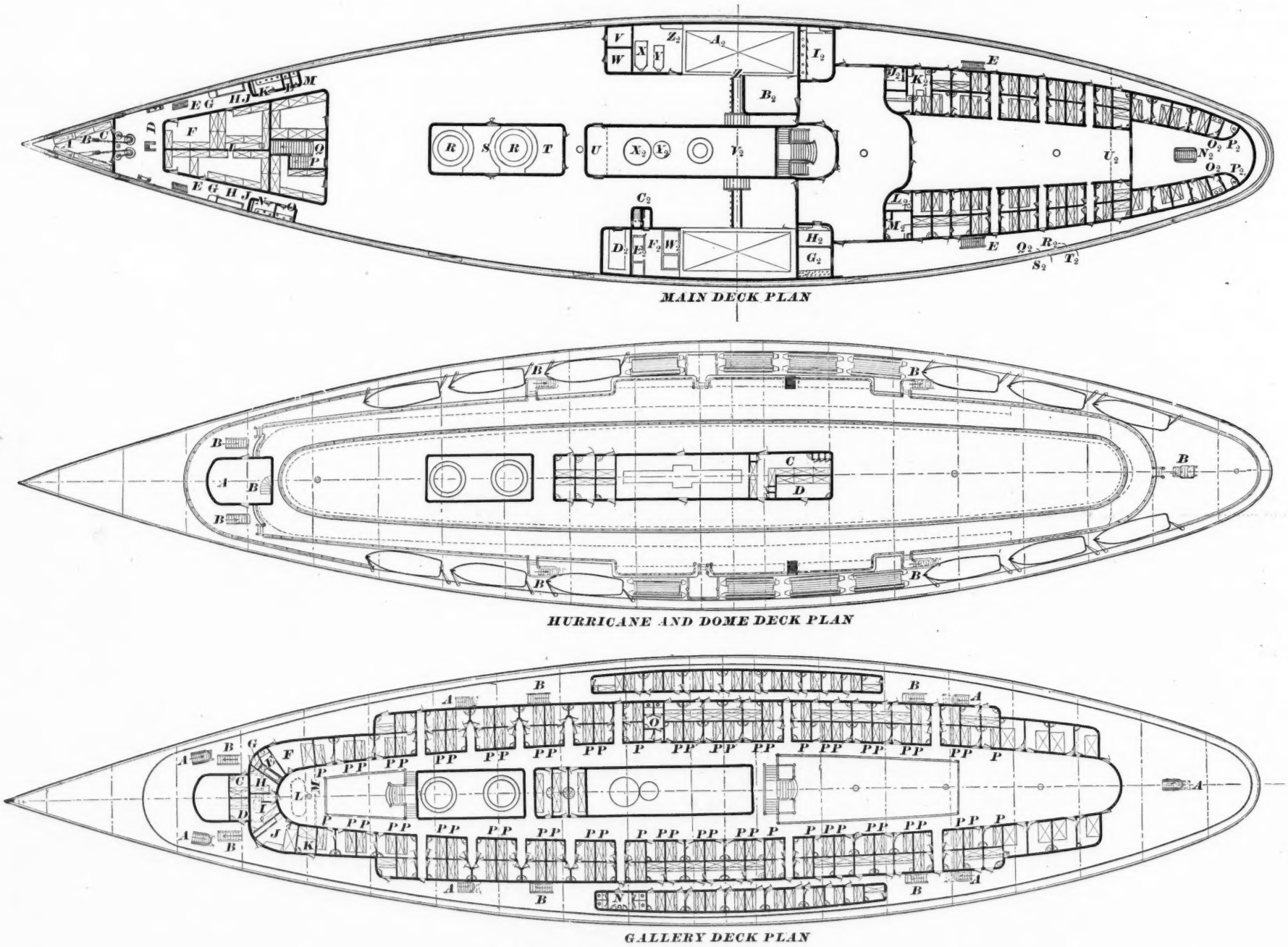
the main deck about 6,600 square feet of deck space can be used for carrying freight, affording about 80,000 cubic feet of freight room. Probably the elegant and handsomely furnished "grand saloon" shown on the saloon deck plan will have the greatest attraction for the passengers. Access to this saloon is by the staircases aft and forward of the engine and boiler enclosures, and also by the stairway *B*. The staircases aft and forward of the engine and boiler enclosures also lead up to gallery deck. The staterooms *P*, *P*, are conveniently arranged along the sides of the grand saloon, leaving considerable space between the staterooms and the boiler and engine enclosure, so as to form a continuous promenade around the saloon. On this deck, *L* and *K* are the gentlemen's toilet rooms; *D*, *E*, the ladies' toilet rooms. *F* is the stewardess' room, and *G* the engineer's room. On this deck there is also a continuous outer promenade, extending outside of the wheels.

The presidents', captains', and officers' rooms are forward on the gallery deck. The total number of staterooms on all the decks is 360. The hurricane deck is arranged for a promenade 10 feet wide, extending entirely around its outer edge, affording a continuous walk of 600 feet. The room *C* will be occupied by the members of the band, and *D* by the life-saving crew. *A* is the pilot house. Referring to the hurricane and dome deck plan, it will be seen the steamer is well provided with life-boats and life-rafts.

In order to give some idea of the strength of some parts of the machinery, it may be stated that each shaft weighs about 40 tons; the total weight of each feathering wheel is about 100 tons; walking beam about 42 tons.

The "Puritan" has been designed by Mr. George Peirce, supervisor of steamboats for the Old Colony Steamboat Company. The sole contractor for her construction from beginning to end is the W. & A. Fletcher Company, of New York. The joiner work, including plumbing and painting, is by Mr. William Rowland, of New York. The hull was built by the Delaware River Iron Shipbuilding and Engine Works, Chester, Pa. The designs for the decorations are by Mr. Frank Hill Smith, of Boston.



The Steamboat Puritan.—See Page 1.

The Modern Steam Plant and its Management.

By Peter H. Bullock.

STEAM DAMPERS, PIPE COVERING AND VALVES.

There are few appliances in or about a boiler room more convenient and useful than a good damper regulator. These can now be had that will move the damper through its whole range of motion by a variation of two lbs. pressure. But do not think that because you have a good regulator it will do to neglect careful firing, for the damper will simply do what it is made for; it will not perform miracles or correct unskillful methods in managing a furnace.

There is another subject that is of the greatest importance as a direct means of economy, but which is often neglected. This is the proper covering of steam pipes and boilers, to prevent loss of heat from radiation. It is worse to throw away heat in this way than it is to waste the fuel before being burned, as this heat not only represents the fuel that it takes to produce it, the wear of the boilers and the labor incident to its production, but the heat that is radiated from the outside of the pipes is represented by water inside of it or else by a lower pressure and temperature. It is especially undesirable that steam should carry entrained water, for this quickly carries off the oil from the valve seats and cylinder of an engine or pump, leaving them dry and more liable to cut, and, if the steam is used for heating, it causes snapping in the pipes and radiators. It is also frequently the cause of a poor working pump or injector, particularly the latter, owing to the very small aperture through which the steam passes in the form of a jet. A very small amount of water will momentarily obstruct the rapid flow of the steam, and this interruption causes the injector to "break," or stop working unless it is one of the kind that has an automatic overflow valve.

VALVES.

It is fair to presume that, when a valve is put into any pipe or position, that the object is to be able to open or close the connection at pleasure, and that it will be tight and reliable. That one-half of the valves in use are entirely so, the writer does not for one minute believe, the leakage being all the way from a very small amount in many cases up to enough to keep a steam pump moving, as I saw in one case recently.

There are many causes that tend to make valves become leaky—brittle or too soft metal used in their construction being a principal one. Small bits of iron chips from the pipe dies, mixed with red lead and dirt that should have been blown from the pipe, get stuck on the disk or seat, and the steam bakes it right on solid, then when the valve is closed it cuts or jams the seat, and the valve will leak, in spite of all muscular efforts at the wheel. This leak may be so small that it is not all steam, but partly water that alternates with the steam, quickly cutting the metal away, and the small leak soon grows to be a large one.

Many of the alkali compounds used in boilers for preventing scale are very destructive to valves; the soda or other detergent crystallizing on the seats forms a sharp, gritty scale, that readily cuts and wears the metal. This is especially likely to result in cases where the boilers foam, as the water then brings over anything held in solution.

Another cause, and one that, when done, cannot be remedied, is by the pipe being screwed so far into the valve body that its end strikes the side of the seat, pushing it out of shape, directly, as shown in Fig. 3 (page 3), or indirectly, by forcing the sides apart, as shown in Fig. 4. This is frequently found in small valves where the bodies are light, which is usually the case with cheap goods.

Fig. 3 is a direct impression taken from a 1″ globe valve cut open through its center on a line with the stem, and Fig. 4 from a 1¼″ valve cut open on a line at right angles to the stem. [These figures have been reduced one-half by the engraver.] The dotted lines in Fig. 3 show where the metal is cut away and pushed over by the pipe that was screwed too far in. The dotted lines in Fig. 4 show how the sides can be bulged out, pulling the seat out of true, even if the pipe does not directly strike it. Fig. 5 would be a section across on line *A B*, and the dotted lines show how it was spread apart.

It will be seen, then, that the only way to have tight valves is to first procure those made from a heavy pattern, of good metal and good workmanship, especially that part where the disk is secured to the stem. Second, the pipes should have as little dirt and chips left in them as possible, and that little should be thoroughly blown out, after which the valve should be unseated, and anything that may have adhered to it carefully wiped off. Thirdly, care should be taken that the pipe is screwed in just far enough, but not so far as to press the seat out of shape either directly or indirectly as shown, and lastly by all means avoid foaming or priming in the boiler, for this certainly indicates that something is wrong with the boiler or the water, and

the cause for it should be sought out and the difficulty remedied.

The question is often asked: Which is the proper way to put on globe valves, with the pressure on top or under the seat? and the answer is given about as often one way as the other. There is not, nor can there be any fixed rule regarding this, for places will be found where it will be best to do exactly the opposite from what would be proper in another case, or under different conditions. As a usual thing, however, if the valve is in a place where, when closed, there is a pressure on one side of it only, it is better to put it on with steam under the seat, as this prevents leakage at the stuffing-box, and permits the stem to be packed when closed.

Perhaps the most common trouble with valves, except leaking, is the disk getting loose on the stem or entirely detached from it. In the latter case, if the pressure is on top of the seat the stem turns back, leaving the valve closed; if under the seat the disk will be thrown back as the stem is turned, and quite likely drop to one side, in which case all control of the valve is lost, only that it is open instead of closed as in the other case. This is a very awkward thing to happen to a blow-off or feed valve to a boiler, and is one very good reason why some other style of valve or cock should be used for these purposes.

This once happened to the feed valve of a boiler the writer had charge of. In this case the disk had a round guide stem on its under side, that worked through a guide-bar across the seat. This kept it in place, and the pressure from the pump closed it to the seat, preventing any water from entering the boiler. Nothing could be done except to draw the fire, cool down, and repair damages.

There is a plant in Maine that includes a steam fire pump, the throttle of which was a common 2″ globe valve put on with the steam on top of the seat. One day, when giving an exhibition before some insurance agents, to show them how perfectly they were protected, the pump was stopped for some purpose, and, when trying to start again, the nut holding the disk to the stem stripped its thread, leaving the valve tightly closed. There was no further exhibition that day, the reputation of the fire apparatus was injured, and the expected reduction in premiums was not secured. Had the valve been on the other way it might not have failed so soon, but poor material or workmanship is bound to show in time, and it might have come off at a time when it would have been nearly as bad to have been unable to stop as it was not being able to start.

Sometimes the thread inside and on top of the disk is cut down too deep, or so far as to nearly come through to the part where it is ground to the seat, and not leaving metal enough to stand the strain of the stem as it is screwed down against it. There is now before me a 1″ nickel-plated angle radiator valve that gave out in this way, and the amount of metal in the annular fracture is about ¼ of an inch square, or 1-16 of a square inch in area. This small amount of metal was not enough to stand the strain of ordinary use, and it failed, as might have been expected had its weakness been known. This set me to wondering how much force one could exert through the medium of an ordinary 3″ valve wheel, the thread on the stem being six to the inch. An iron weight with a lever between guides and a clamp for holding the valve stem made a good rig for this purpose. I was aware that my right hand was mightier with a wheel than with a pen, but I did not suppose that by an ordinary first degree grip on a 3″ valve wheel that I could exert a pressure of 500 lbs. on the seat of a 1″ radiator valve, but such was the fact.

Assuming that the disk failed at the strain mentioned, it would indicate that the metal was very poor, for if ¼ square inch gave way at 500 lbs. it would show a tensile strength of but 8,000 lbs. per square inch of section, which is far below the strength given for brass by any of the best authorities.

This experiment set me to thinking about larger valves and the strain on the joint between the body and stem-stock. A 3″ iron

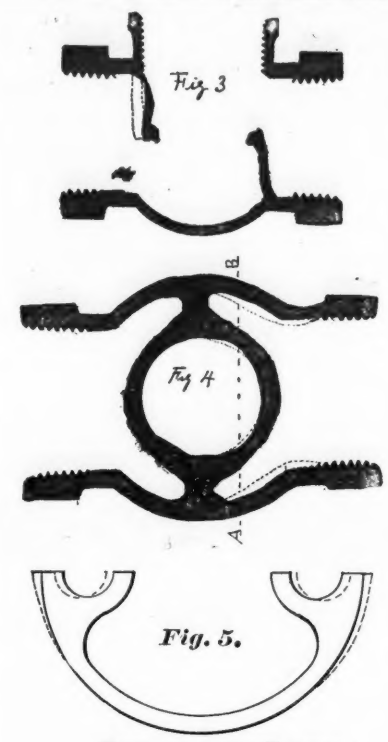
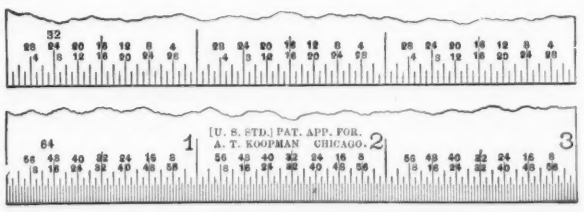


Fig. 5.

TROUBLE WITH VALVES.

body globe valve was next dissected. This had an iron wheel 7″ and a brass stem ⅞ inch in diameter, with four threads to the inch. The area under the joint and exposed to the pressure was 13 square inches, and the steam pressure 90 lbs. making 1,270 lbs. strain on the joint before any more was put on to it by the wheel and stem. This wheel was large enough to get both hands hold of it, and I saw one of my men exert a pressure of 1,500 lbs. arranged as above described. (Modesty prevents the insertion of my own record.) This would make a possible strain on the joint of 2,770 lbs. The amount of metal resisting this strain consists of six male threads, 16 to the inch, on the outside of the brass stem-stock, which is screwed into the same number of threads on the inside of the cast-iron valve body. In this case the threads fit each other nicely, the metal is apparently good, and probably the strength is ample for any reasonable pressure or fair usage. But were the metal and workmanship poor, and the strength of same man, as is often the case, applied at the end of a monkey-wrench on the rim of the wheel, the result might be different and disastrous.

Angle valves have stems longer in proportion than the straight globe valves, and if the stem is made to allow the disk to draw clear back into the arch of the stem-stock, nearly half of its length will be outside of the stuffing-box, and consequently may become comparatively cool. Now if a valve like this is quickly closed, especially if the steam is top of the seat, a great strain is put on all the parts by the expansion of the stem, and there is danger that the seat will be sprung or the joint started. The latter happened many years ago to the writer, and injuries then received have been an ever-present reminder of the danger incurred in too quickly closing a valve under these conditions.



An Improvement in Scales.

Every machinist is familiar with the difficulty met with in making measurements by the smaller divisions of the inch, such as thirty seconds or sixty-fourths.

The expression, forty-seven sixty-fourths, for instance, conveys to most mechanics a very dim idea of magnitude, and in most cases no definite conception of its value is arrived at until after "counting up" on a scale, or some mental calculation. It is a quite common occurrence for mistakes to be made in these operations, and often very expensive ones.

The illustration accompanying this shows two edges of a scale, in which this difficulty is met by designating in figures every fourth graduation of the thirty-seconds, and every eighth graduation of the sixty-fourths, so that any number of either graduations may be instantly read off direct, the figures being put on both ways, so that values may be read from left to right, or vice versa.

Reference to the cut will show the facility with which any number of thirty-seconds or sixty-fourths can be almost instantly found and compared with a measurement expressed in any other fraction of an inch. The other side of the scale is graduated in sixteenths and eighths as usual, and they are made in various lengths, from one to seventy-two inches, spring tempered, and accurately graduated either to U. S. standard or to the metric system.

The maker is A. T. Koopman, Chicago, Ill.

A New Adjustment for Dies.

The illustration shows a new threading die brought out by J. M. Carpenter, Pawtucket, R. I., the special feature of which consists in the insertion of a taper pin into a hole reamed for its reception in the slot or opening, and intended to serve the purpose of the more costly collet or collar in which such dies are usually placed. In making these dies, they are so made as to have a tendency to spring together or close up the opening, which makes them grasp the pin firmly. When worn large it is only necessary to drive the pin out slightly, when the die closes. After properly adjusting the size, the projecting end of the pin can be smoothed off. Should the two parts of the die be sprung sidewise in hardening, the insertion of the pin restores them to their proper places, making the threads match as before.

By this means the peculiar advantages of

NEW ADJUSTMENT FOR DIES.

a solid die are secured, and yet it can readily be adjusted. Neither is it necessary to readjust it each time it is placed in the stock or holder, as is the case with many of the open dies, and which occasions so much annoyance and loss of time in their use.

It will thus be seen that, by this simple device, a die is provided, which, when it leaves the factory, is practically solid and of standard size, and which can be placed and replaced in a collet, plate or chuck any number of times and always cut the same size until wear takes place, which can readily be compensated for in the manner shown.

These dies are made, we are informed, in a variety of sizes.

A New Street Cleaner.

A new machine for sweeping the streets and automatically elevating the sweepings into a cart in front of it, while traveling, was exhibited in operation yesterday on Holborn viaduct. It consists of a series of horizontal brushes fixed on a pair of endless chains, revolving around spindles. These brushes sweep the mud up a short incline into a receiver, which is continued upward as a thin iron casing. Inside this casing is a series of scoops or buckets, fixed on endless chains, and these dip into the receiver and lift the mud to a delivery shoot, whence it is delivered into an ordinary mud cart, to the rear of which the apparatus is connected in such a way that it is easily removed. When the cart is full the sweeping mechanism is detached from it, and attached to an empty cart, the full one being sent on its way to discharge its contents and return. The apparatus is mounted on traveling wheels, and motion is imparted from them to the mechanism by gearing. The machine does its work in a cleanly and practical manner, and dispenses with the necessity for unsightly mud heaps at the roadside, and the splashing of the public when those accumulations are being shovelled into carts by hand. Thick mud was spread for the machine to gather yesterday, and in its first run it did its work thoroughly, but in the second run not quite so well. It is, however, but right to state that the mud was thicker than that ordinarily found on roads, for it had been swept up, carted and re-deposited, and had consequently parted with some of its moisture. We have, however, seen the apparatus at work on a macadamized road on a very dirty day with perfect success. The trials yesterday were carried out by permission of the Commissioners of Sewers of the city of London, and with their men, horses and carts.—*The London Times.*

Modern Locomotive Construction.

BY J. G. A. MEYER.

EIGHTY-SEVENTH PAPER.

In our last paper we have given rules for determining the dimensions of the journals for the main crank-pins (made of steel), for ten-wheeled, mogul and consolidation engines.

The dimensions of the main crank-pin journals given in the tables marked *F, G, H, I, J,* have been computed by those rules.

TABLE F.

Dimensions of the main crank-pin journals (steel) for mogul, ten-wheeled, and consolidation engines. Maximum steam pressure on the piston, 120 pounds per square inch.

Diam. of Cylinder.	Main Rod Journal.		Side Rod Journal.	
	Diam.	Length.	Diam.	Length.
9	2¼ in.	2¼ in.	2¼ in.	2 in.
10	2⅜ "	2⅜ "	2¾ "	2⅛ "
11	2¾ "	2⅞ "	3 "	2⅜ "
12	3 "	2⅞ "	3⅜ "	2⅝ "
13	3¼ "	3⅛ "	3⅝ "	2¾ "
14	3⅜ "	3⅜ "	3⅞ "	3 "
15	3¾ "	3⅝ "	4⅛ "	3¼ "
16	4 "	3⅞ "	4⅜ "	3½ "
17	4¼ "	4⅛ "	4¾ "	3⅝ "
18	4½ "	4⅜ "	5 "	3⅞ "
19	4¾ "	4⅝ "	5¼ "	4⅛ "
20	5 "	4⅞ "	5½ "	4⅜ "
21	5¼ "	5⅛ "	5¾ "	4½ "
22	5½ "	5⅜ "	6 "	4¾ "

TABLE G.

Dimensions of the main crank-pin journals (steel) for mogul, ten-wheeled, and consolidation engines. Maximum steam pressure on the piston, 130 pounds per square inch.

Diam. of Cylinder.	Main Rod Journal.		Side Rod Journal.	
	Diam.	Length.	Diam.	Length.
9	2⅜ in.	2¼ in.	2⅝ in.	2 in.
10	2⅝ "	2⅜ "	2⅞ "	2¼ "
11	2⅞ "	2¾ "	3¼ "	2⅜ "
12	3⅛ "	3 "	3⅛ "	2¾ "
13	3⅜ "	3¼ "	3⅞ "	3 "
14	3⅝ "	3½ "	4 "	3⅛ "
15	3⅞ "	3¾ "	4¼ "	3⅜ "
16	4⅛ "	4 "	4⅝ "	3⅝ "
17	4⅜ "	4¼ "	4⅞ "	3⅞ "
18	4⅝ "	4½ "	5⅛ "	4 "
19	4⅞ "	4¾ "	5⅜ "	4¼ "
20	5⅛ "	5 "	5¾ "	4½ "
21	5⅜ "	5¼ "	6 "	4¾ "
22	5⅝ "	5½ "	6¼ "	5 "

TABLE H.

Dimensions of the main crank-pin journals (steel) for mogul, ten-wheeled, and consolidation engines. Maximum steam pressure on the piston, 140 pounds per square inch.

Diam. of Cylinder.	Main Rod Journal.		Side Rod Journal.	
	Diam.	Length.	Diam.	Length.
9	2⅛ in.	2⅜ in.	2¾ in.	2⅛ in.
10	2¾ "	2⅝ "	3 "	2⅜ "
11	3 "	2⅞ "	3¼ "	2½ "
12	3¼ "	3⅛ "	3⅜ "	2¾ "
13	3½ "	3⅜ "	3⅞ "	3 "
14	3¾ "	3⅝ "	4⅛ "	3¼ "
15	4 "	3⅞ "	4⅜ "	3½ "
16	4¼ "	4⅛ "	4¾ "	3¾ "
17	4½ "	4⅜ "	5 "	4 "
18	4¾ "	4⅝ "	5⅜ "	4¼ "
19	5⅛ "	5 "	5⅝ "	4½ "
20	5⅜ "	5¼ "	5⅞ "	4⅝ "
21	5⅝ "	5½ "	6¼ "	4⅞ "
22	5⅞ "	5¾ "	6⅜ "	5⅛ "

TABLE I.

Dimensions of the main crank-pin journals (steel) for mogul, ten-wheeled, and consolidation engines. Maximum steam pressure on the piston, 150 pounds per square inch.

Diam. of Cylinder.	Main Rod Journal.		Side Rod Journal.	
	Diam.	Length.	Diam.	Length.
9	2½ in.	2⅝ in.	2¾ in.	2½ in.
10	2¾ "	2⅞ "	3⅛ "	2⅝ "
11	3⅛ "	3 "	3⅜ "	2⅞ "
12	3⅜ "	3¼ "	3¾ "	2⅞ "
13	3⅝ "	3½ "	4 "	3⅛ "
14	3⅞ "	3¾ "	4¼ "	3⅜ "
15	4⅛ "	4 "	4⅜ "	3⅝ "
16	4⅜ "	4⅛ "	4⅝ "	3⅞ "
17	4⅝ "	4¾ "	5⅛ "	4 "
18	5 "	4⅞ "	5⅜ "	4⅛ "
19	5¼ "	5⅛ "	5⅝ "	4¾ "
20	5½ "	5⅜ "	6⅛ "	4⅞ "
21	5¾ "	5⅝ "	6⅜ "	5⅛ "
22	6⅛ "	6 "	6⅝ "	5⅜ "

TABLE J.

Dimensions of the main crank-pin journals (steel) for mogul, ten-wheeled, and consolidation engines. Maximum steam pressure on the piston, 160 pounds per square inch.

Diam. of Cylinder.	Main Rod Journal.		Side Rod Journal.	
	Diam.	Length.	Diam.	Length.
9	2⅝ in.	2½ in.	2⅞ in.	2¼ in.
10	2⅞ "	2¾ "	3¼ "	2½ "
11	3¼ "	3 "	3½ "	2¾ "
12	3½ "	3⅜ "	3⅞ "	3 "
13	3¾ "	3⅝ "	4⅛ "	3¼ "
14	4 "	3⅞ "	4½ "	3½ "
15	4¼ "	4⅛ "	4¾ "	3¾ "
16	4½ "	4⅜ "	5⅛ "	4 "
17	4⅞ "	4¾ "	5½ "	4¼ "
18	5⅛ "	5 "	5¾ "	4½ "
19	5½ "	5⅜ "	6 "	4¾ "
20	5¾ "	5⅝ "	6¼ "	5 "
21	6 "	5⅞ "	6½ "	5¼ "
22	6¼ "	6⅛ "	7 "	5½ "

There are very few mogul engines built with cylinders 9 inches diameter, and we do not know of any consolidation engines with cylinders of such small diameters; it may therefore appear unnecessary to extend the tables to such small cylinders. But we have seen that, in narrow gauge passenger engines, the side rods are often placed next to the driving wheels; these engines generally have small cylinders, consequently these tables are useful for obtaining the dimensions of main crank-pins for this class, and other classes of engines whose side rods are placed next to the driving wheels.

Side rod pins for ten-wheeled and mogul engines. In comparing the side rod pins for ten-wheeled and mogul engines with the side rod pins for eight-wheeled passenger engines whose cylinders are equal in size to those in the former classes of engines, and all subjected to the same steam pressure, we find that the side rod pins in ten-wheeled and mogul engines are smaller than those in eight-wheeled passenger engines. The reason for this is that in passenger engines we have only two driving wheels on each side, and in ten-wheeled and mogul engines we have three driving wheels on each side. With cylinders of equal size and equal steam pressures, the thrust on the main rod crank-pin journals in all the different classes of engines will be practically equal. Now assuming that the total weight on the driving wheels is equally distributed on these wheels, the pressure on the side rod pins in ten-wheeled and mogul engines must be less than that on the side rod pins in passenger engines, because in the latter class nearly all the pressure on the main pin is transmitted to two wheels, whereas, in the former class, an equal amount of pressure is transmitted to three wheels. Hence, the rules previously given for determining the dimensions of the side rod pin for eight-wheeled passenger engines are not suitable for finding the dimensions of the side rod pins for ten-wheeled and mogul engines.

The following rules will give results which agree closely with the average good practice.

Rule 77.—Divide the total steam pressure on the piston by 2,800; the quotient will be the number of square inches in the projected area of steel side rod pins in the front and rear driving wheels under ten-wheeled and mogul engines.

Rule 78.—To find the diameter and length of the front and rear side rod pins in the above classes of engines, extract the square root of the projected area, as found by Rule 77. If this square root does not contain any fractions, or if it does contain fractions which can be divided by ⅛ inch, add to it ⅛ of an inch for wear; the sum will be the diameter of the pins. If the square root contains fractions which cannot be divided by ⅛ inch, add about $\frac{1}{16}$ inch, or a little more, so as to obtain diameters which are divisible by ⅛ of an inch. The square root of the projected area will also be the length of the pins; if it is not divisible by ⅛ of an inch, adopt the nearest value which is divisible by ⅛ inch.

Example 108.—Find the diameter and length of the front and rear side rod pins in a mogul engine having cylinders 18 inches diameter; maximum steam pressure on the piston, 130 pounds per square inch.

The total steam pressure on the piston is equal to its area multiplied by the steam pressure per square inch, therefore:

$254.47 \times 130 = 33{,}081.10$ pounds = total pressure on the piston.

According to Rule 77 the projected area is equal to

$$\frac{33{,}081.10}{2{,}800} = 11.81 \text{ square inches.}$$

According to Rule 78 we must find the square root of 11.81, which is 3.43, or, we may say it is practically equal to $3\frac{7}{16}$ inches; hence, the diameter of this pin is 3¼ inches and its length 3⅜ inches.

In a similar manner the dimensions of steel side rod pins for ten-wheeled and mogul engines in the following tables have been computed:

TABLE K.

Dimensions of steel side rod pins in the front and rear wheels for ten-wheeled and mogul engines. Maximum steam pressure on the piston, 120 pounds per square inch.

Diameter of Cylinder.	Diameter of Journal.	Length of Journal.
9	1⅞ inches.	1¾ inches.
10	2 "	1⅞ "
11	2⅛ "	2 "
12	2¼ "	2¼ "
13	2⅜ "	2⅜ "
14	2½ "	2½ "
15	2⅝ "	2¾ "
16	2¾ "	3 "
17	2⅞ "	3⅛ "
18	3 "	3⅜ "
19	3⅛ "	3½ "
20	3¼ "	3⅝ "
21	3⅜ "	3¾ "
22	3½ "	4 "

TABLE L.

Dimensions of steel side rod pins in the front and rear wheels for ten-wheeled and mogul engines. Maximum steam pressure on the piston, 130 pounds per square inch.

Diameter of Cylinder.	Diameter of Journal.	Length of Journal.
9	1⅞ inches.	1¾ inches.
10	2 "	1⅞ "
11	2¼ "	2⅛ "
12	2⅜ "	2¼ "
13	2⅝ "	2½ "
14	2¾ "	2⅝ "
15	3 "	2⅞ "
16	3⅛ "	3 "
17	3⅜ "	3¼ "
18	3½ "	3⅜ "
19	3⅝ "	3½ "
20	3⅞ "	3¾ "
21	4⅛ "	4 "
22	4¼ "	4¼ "

TABLE M.

Dimensions of steel side rod pins in the front and rear wheels for ten-wheeled and mogul engines. Maximum steam pressure on the piston, 140 pounds per square inch.

Diameter of Cylinder.	Diameter of Journal.	Length of Journal.
9	1⅞ inches.	1¾ inches.
10	2⅛ "	2 "
11	2¼ "	2⅛ "
12	2½ "	2⅜ "
13	2⅝ "	2½ "
14	2⅞ "	2¾ "
15	3⅛ "	3 "
16	3¼ "	3⅛ "
17	3½ "	3⅜ "
18	3⅝ "	3½ "
19	3⅞ "	3¾ "
20	4⅛ "	4 "
21	4¼ "	4⅛ "
22	4½ "	4⅜ "

TABLE N.

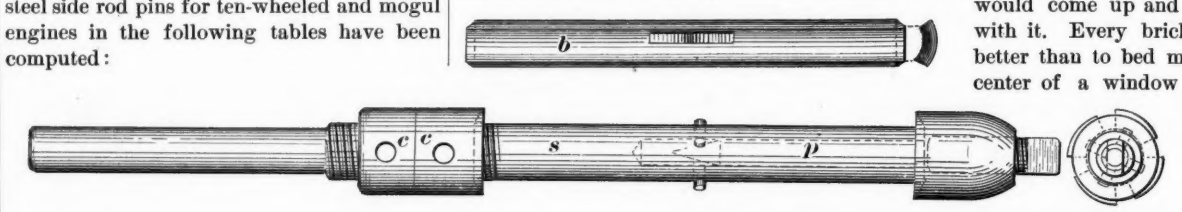
Dimensions of steel side rod pins in the front and rear wheels for ten-wheeled and mogul engines. Maximum steam pressure on the piston, 150 pounds per square inch.

Diameter of Cylinder.	Diameter of Journal.	Length of Journal.
9	2 inches.	1⅞ inches.
10	2⅛ "	2 "
11	2⅜ "	2¼ "
12	2⅝ "	2½ "
13	2¾ "	2⅝ "
14	3 "	2⅞ "
15	3⅛ "	3 "
16	3⅜ "	3¼ "
17	3⅝ "	3½ "
18	3⅞ "	3⅝ "
19	4 "	3⅞ "
20	4¼ "	4⅛ "
21	4½ "	4⅜ "
22	4¾ "	4½ "

TABLE O.

Dimensions of steel side rod pins in the front and rear wheels for ten-wheeled and mogul engines. Maximum steam pressure on the piston, 160 pounds per square inch.

Diameter of Cylinder.	Diameter of Journal.	Length of Journal.
9	2⅛ inches.	2 inches.
10	2¼ "	2⅛ "
11	2½ "	2⅜ "
12	2⅝ "	2½ "
13	2⅞ "	2¾ "
14	3⅛ "	3 "
15	3¼ "	3⅛ "
16	3½ "	3⅜ "
17	3⅝ "	3½ "
18	3⅞ "	3¾ "
19	4⅛ "	4 "
20	4⅜ "	4¼ "
21	4½ "	4⅜ "
22	4¾ "	4⅝ "



An Adjustable Reamer.

In our issue of January 31 it will be remembered that we illustrated a broaching device for broaching round holes instead of reaming them. It was the result of considerable experimenting, to devise a method of sizing large numbers of small holes economically and very accurately to gauge. With this is a sketch showing a reamer, which, among other things, was devised and tried for the purpose, giving very good satisfaction as an adjustable reamer, but was discarded when the plan of broaching was hit upon by the inventor, Mr. Geo. Thompson.

The shank of the reamer is shown with the cutting blades removed, to make the construction more clear. There are four of these blades, the form of which is shown separately.

The lower end of the shank has a head upon it, the shoulder being cut under, as shown. At the upper end are two collars *c c*, which are threaded upon the shank, the inside one having its face cut under to the same angle. The ends of the blades are beveled to fit into this head at one end, and the collar at the other. In the middle of the shank are four small pins, which radiate from the center, and the projecting ends of which enter small slots cut on the inside surface of the blades. These pins are forced outwards when it is desired to enlarge the reamer by applying a wrench to the end of the pin *p*, which is threaded near the head, and pointed at the other extremity where the radiating pins bear upon it. The blades are by this means sprung out in the middle sufficiently to maintain the size. After hardening, they are placed upon an arbor, which holds them in much the same manner as they are held on the shank of the reamer, but the back edge of each blade is raised up a little by suitable packing, so that when they are placed in the shank without this packing, they are in effect "backed off" or given clearance.

The reamer is readily sharpened when dull by loosening the collars, removing the blades and grinding them upon the flat cutting edge, after which they are replaced and the reamer adjusted to size again.

This method of giving clearance to the blades, and the facility with which they can be ground when dull, are the especial features of the tool, which, it seems to us, will make it useful in certain lines of work.

Though there is considerably more work in making it than in some others, yet, when it is remembered that it can be readily and repeatedly sharpened by grinding and restored to size, and also that when the blades are worn out it is only necessary to renew them, the rest of the tool being as good as ever, the expense of making is well repaid where there is use for such a tool. Mr. Thompson has not patented it, and it or any modification of it can be made and used by those desiring to do so.

Prof. John E. Sweet's View of the Corliss Engine Frame.

By Oscar J. Beale.

In the American Machinist of April 28th, 1888, there is a reprint from the *Journal of the Franklin Institute*, of a portion of a lecture on machine designing, by Prof. John E. Sweet, from which I quote the following:

"Many of the modern builders of what Chordal calls the Hyphen Corliss Engine, claim to have made a great advance by putting a post under the center of the frame, but whether in acknowledgment that the frame would be likely to go down, or the stone work come up, I could never make out. What I should fear would be that the stone would come up and take the frame with it. Every brick mason knows better than to bed mortar under the center of a window sill; and this putting a prop under the center of an engine girder seems a parallel case. They say Mr. Corliss would have done the same thing if he had thought of it. I do not believe it. If Mr. Corliss had found his frames too weak, he would soon have found a way to make them stronger."

I read this with great pleasure. The lecture has been extensively copied, and this passage has no doubt been pleasant reading to many. It is good-naturedly facetious, and its style is of that rare kind that can convey an abstract truth in such a way as to hold the reader's attention without wearying him. The name of the lecturer, as well as the association of the names Chordal and Corliss, at once placed his statements among the fundamentals of knowledge, and they were laid in a prominent place in memory. Upon a second reading of the passage I was struck with the amount of thought it suggested, and also with its expressed meaning, that, at first, had escaped me. To these I would like to call the reader's attention. I may not succeed in giving exactly what the professor meant, but I will give what a portion of his readers understand him to mean. A fair construction of his words, taken in their ordinary sense, is that to which we must hold the professor.

I take the expression "Hyphen-Corliss Engine" to mean that the engine to which it is applied is a partial imitation of the Corliss engine, but that in some essential particulars the imitation fails, and in consequence the Hyphen engine is not so good as a Corliss. That is, a Gascon-Corliss engine is not so good as a Corliss. That is, a Gascon-Corliss engine is the best which in it has the most Corliss and least Gascon. My interpretation of this expression does not refer to Chordal's meaning, but only to Prof. Sweet's, as shown by the context. It is about the same as is sometimes conveyed by the word mongrel, and carries with it the odium implied by that word. Divested of its facetiousness and of its overstatement, the expression "that the stone work would come up and take the frame with it," and so on, means that the stone work might move and injure the frame, if the center of the frame is connected to the stone work by a post. The professor appears to think that the center of support is an unhealthy growth, and one that Mr. Corliss never ingrafted, and would not have ingraft-

ed, even had he found his frames too weak.

On the left bank of a small river with a large name, Woonasquatucket, within five miles of the Corliss Steam Engine Co.'s works, is an extensive establishment that has several engines aggregating more than two thousand horse-power. They are not Hyphen-Corliss engines; if I may be allowed to continue in the punctuation strain, they are engines of the Corliss *period*. One, a beam engine, is among the first made by Mr. Corliss, and one which he ever liked to see. It lived with him always, and as a souvenir of his early success, held his interest to the end. More to our purpose is the next, a horizontal, one thousand horse-power, double engine, which was remodeled by Mr. Corliss in 1879. Under each frame of this engine, about halfway between the cylinder and the pillow block, there is fastened a post that goes down through the floor of the engine room. To each post is attached a part of the valve gear. It might be said that these posts were designed simply to hold the valve gear, though I have no doubt that they are fastened to the stone work under the floor. Still more to our purpose is another engine that was shown to me, which was made by Mr. Corliss in 1884. This is a two-crank engine, but at present only one crank is in use. It is double cylinder compound, both pistons being on one rod. There will be two more cylinders when the other crank is connected. It is at present indicating six hundred horse-power, being intended for twelve hundred when completed. Under the frame of this engine is a center supporting post, pure and simple, to it no valve gear being attached. Hence we conclude that Mr. Corliss, years ago, not only did think of the "props," but also put them under the center of his frames.

Did later experience lead Mr. Corliss to make his frames stronger and leave out the props?

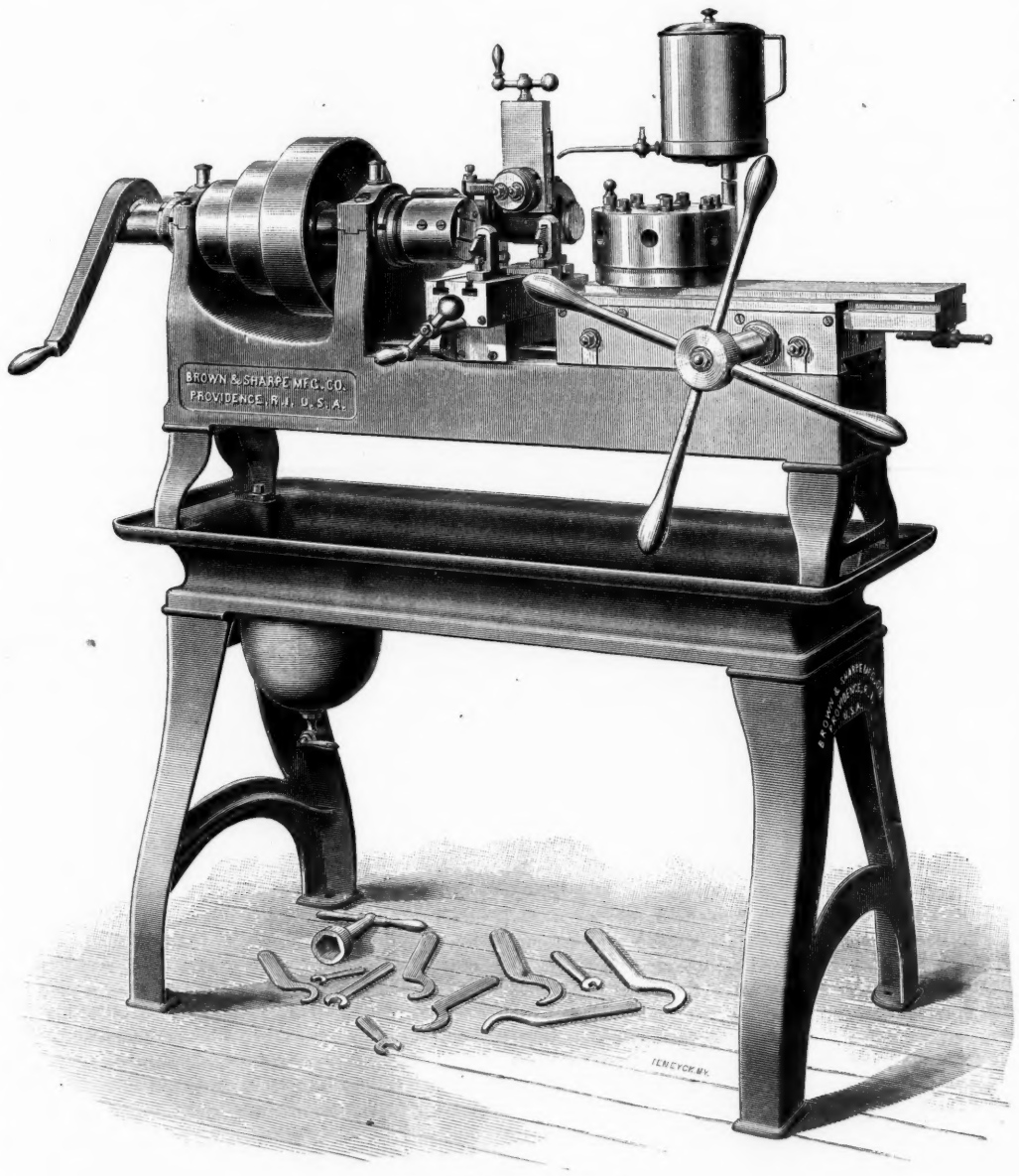
On the left bank of the Blackstone river, within a dozen miles of his works, are two large engines that are among the last that he ever made. Each engine is compound, having two cylinders and two cranks. They were calculated for thirteen hundred horse-power, but, at present, they together indicate sixteen hundred. I made a special trip to these engines to see how frames look that are strong enough without props. These are not of that kind, for under each of the four frames Mr. Corliss has put a prop. These props are not fastened to the frames, but simply hold them up, being only props. The top of each is a cup into which rests a boss that is cast to the under part of the frame. Each prop has two feet that are held, both top and bottom, by nuts on screws that are fastened into the stone work. Hence it will be seen that the props do not touch the stone work, and that they are adjustable. The engines run "over," as the direction is called by some engineers; that is, the cranks, when above the shafts, move away from the cylinders. Since the engines turn in this direction, the pressure of the crossheads upon the slides is always downward. It would appear that this is the reason why Mr. Corliss did not fasten the props to the frames of these engines, as he did the posts in the case of the engines first named.

And so the fundamental (?) that I supposed I had obtained from Prof. Sweet, slid from under me.

The error of the Professor's passage quoted, comes from the fallacy of non-observation or neglecting facts that ought to have been observed. After referring to the frame several times by that name, he calls it an engine girder, which, taken with the context, implies that it is only a girder. Here we have the fallacy of mal-observation; that is, the fact is not simply unseen, but seen wrong. Though it may be a girder in one sense, the frame is as often a strut as it is a girder; for, when the piston is moving away from the crank-shaft, the principal pressure of the pillow block upon the frame tends to compress it, thereby using it as a strut. Moreover, at each movement of the piston the frame is used as a beam. In the large engines last referred to, the pressure of a crosshead upon its lower slide amounts to several tons at each movement of the piston. This pressure is applied intermittently—a thing much dreaded by constructors.

The superintendent of a large manufactory of Hyphen-Corliss engines tells me that he has never known a case of injury to a frame from any such change as the professor suggests.

If the survival of the fittest obtains, as in accordance with some of the best thinking of our time, the fact that there are so many of these Hyphen builders, as by the Professor's acknowledgment, shows that the world has a use for them, or, at least, for their engines. I do not understand why *many* builders should "claim" to have made a great advance, when they are doing exactly what Mr. Corliss did. Must we conclude that "*many* builders" have fallen into the same error as the Professor? If so, I invite them to come with me to the left banks of the Woonasquatucket and the Blackstone.



No. 5 SCREW MACHINE.

Brown & Sharpe No. 5 Screw Machine.

This machine is suitable for making all kinds of screws and studs ordinarily used in a machine shop, also for finishing from the rough bar, or from forgings or castings, many small pieces or parts of machines. Ten tools can be used while the work is held by the chuck in one position, and thus uniformity and accuracy are insured, and a saving of time is effected with a corresponding reduction in cost.

The spindle-boxes, $2\frac{3}{4}$ inches and $2\frac{1}{4}$ inches in diameter, and $3\frac{7}{8}$ inches and $2\frac{7}{8}$ inches long, are steel, hardened and ground inside and out. The spindle is also steel; its front bearing is hardened, and both bearings are ground.

The spindle cone has three grades, 6 inches, $8\frac{1}{2}$ inches and 11 inches diameter, for 3-inch belt. Size of hole through spindle, $1\frac{9}{32}$ inches; number of holes in revolving head, 7; diameter of holes in revolving head, $1\frac{1}{16}$ inches; movement of revolving head slide, $9\frac{5}{8}$ inches; length that can be milled, 6 inches; swing over slide rest, $6\frac{1}{2}$ inches; swing over bed, $13\frac{5}{8}$ inches; length of bed, 50 inches.

The countershaft has friction pulleys 14 inches diameter, $3\frac{1}{2}$ inches face, and should run 190 turns per minute.

The weight of machine ready for shipment is 1,450 pounds. Floor space measured over extreme projections, 32 x 62 inches.

A lever, to be used in operating the cutting-off slide in place of the screw shown in cut, is furnished when desired. The turret head is secured in position by a simple and durable device.

LETTERS FROM PRACTICAL MEN.

The Steel Question.

Editor American Machinist:

The admirable treatment of, in my judgment, one of the most important subjects to the mechanic, in the editorial columns of the AMERICAN MACHINIST of dates February 7th and 14th, 1889, under the headings, "Regarding Steel," and, "Some Further Points About Steel," with the communications in reply, from "P. Barnes," and "A User," in the issue of February 21st, prompts me to undertake to emphasize some of the truths so well stated, and at the same time to, if possible, throw more light upon a question with which all steel users are wrestling with such varied success as to keep consumers, manufacturers, and dealers in steel, in a chronic state of uncertainty as to the right thing to use on the one hand, or to furnish on the other.

The point made at the beginning of your editorial "Regarding Steel," is well taken, but is it true that managers are, as they see it, any less attentive to the matter of securing steel best adapted to their use for tools than in the matter of machinery and other supplies? Some of them are practical steel workers and decide what shall be used through personal experiment and observation. Others, just as competent to decide, leave it all to men in their employ who are supposed to be "up" in the matter. But many do not pretend to know anything about steel, and of course must be governed by the reports of their employes who use the steel, or by the representations from the army of men who are each continually urging the adoption of the particular steel which they are told will relieve them from all their troubles steelwise, or, mayhap, the inducement is in the direction of price, and the manager, being a business man, dealing with figures rather than mechanics, and having come to the conclusion that "there is not much difference in steel anyhow," the lower prices offered from time to time, showing a saving of from ten to fifty per cent. from what he is using, it is not strange that he succumbs to the entreaties of "steel men," and often changes from bad to worse.

Among the most serious obstacles to the adoption of a right steel for any particular purpose is the persistent and determined search on the part of consumers, for steel which may be abused with impunity, which is backed up by an experience of their own, or of others, and which, as they put it, makes them morally certain that "a *good* steel may be hardened at an extremely low heat, barely red, and still it will not hurt it to heat it for hardening to a high yellow heat, almost white."

With too many men this is the ideal steel which they are sure they have sometimes used, or have seen used, or have heard of through others—something to stand a broad variation of heat, and still never crack in hardening, and to always make good tools. To those who have carefully looked into the matter there is no need of saying that the search will never be rewarded. No such steel has been made at any time. No such steel will be made, and further, for all hard service, for all tools requiring to show exceptional qualities in the direction of durability under severe treatment, as a rule the steel which shows not the "broadest margin," as asked for, but the narrowest, that which calls for the greatest care to heat just right for hardening, is the steel from the use of which will be had the best results. This bears upon the second proposition, *i. e.*, "temper," "per cent. of carbon." And just here comes one of the hardest pitches to get over on the whole road in coming to a knowledge of why "the steel which will stand the most abuse" is the last steel to select for hard service.

Do I know that the testimony is against my proposition? I do; that is, if it is measured up by bulk. But I know at the same time that facts usually stand against any amount of testimony. Suppose we find some advocate of one of the wonderful brands of imported steel from which, as he says, all sorts of tools can be made, wrestling with a job of turning or planing on hard stock—steel castings, if you please—and utterly unable to make from his favorite steel, by which he swears, any tools which will stand even reasonably well, and that on the first attempt a tool is made from an American steel which not only cuts the hard stuff, but keeps on cutting it with no more trouble, and retaining its edge as long as would the old standard English steel on soft work, if it is planing, carrying a good clean cut clear across a piece a foot or more in width where the old favorite tool stopped for grinding at every half inch, and did no good work anyhow?

Here is a fact; what will be done with it? This: send to the favorite English manufacturer for some steel suited to the work. It is as much a question of being fitted in steel as in

boots. I wear number eights, but suppose I simply buy eights without reference to shape. But I am drifting into my old long-winded style. Let's make a center shot. Strange to say, the ground which has been taken by you, in favor of American steel as against imported, is the one on which you will be most sharply criticized, and this in face of the fact that in hundreds, yes, thousands of shops, American steel is being used with as good results as ever attended the use of any English steel; and why not? If steel is made in this country of the best Dannemora iron—and it is, and made by men who served their time among the best English steel manufacturers "at 'ome"—it does seem as though it ought to be as good as the imported steel, doesn't it? And it is. Not in the way in which some grudgingly admit its good qualities, who say, "Oh, yes, there is some good American steel, sample bars that are all right, but when you want it in quantity that's another thing; it is not uniform," but by the ton, by the car load, by the thousands of tons if you please, not made to order, but carried in stock, each grade and temper classified and running as uniform as any imported steel.

Did I say uniform, strictly uniform? No, I did not, nor can it be said, nor could it ever be said of any English steel; I said *as uniform*, and I say it with a full realization of just what it means under the light of forty years' experience as a steel worker, which carries me back to a time when no American steel had found a foothold.

Of course I have had my turn in wrestling with worthless American steel; so I have with worthless English steel, sometimes because really worthless, sometimes worthless to me because not adapted to my work, sometimes worthless to me because I could not bring myself to suit my treatment to the particular steel in hand. I reckon that my experience has been much like that of the rest of you. But I am intensely American. That has, perhaps, helped me to arrive at my present belief about American steel, and I am ready to be put on record as asserting broadly that there is not a steel imported which cannot be fully equaled by American steel through all the broad ranges of uses to which steel is put.

It would be unbecoming in me to charge my fellow steel-workers with being prejudiced because they differ with me so broadly as to say that, after trying all the best American steels, for certain uses, they have been obliged to fall back upon some one brand of English steel as the *only* thing to do their work. Let me state one case in closing and leave the reader to draw his own conclusions.

Said a foreman machinist: "There is only one steel of which these pieces can be made successfully. Of course it costs high, over thirty cents per pound; it's imported steel. But there is no American steel which can be hardened and re-hardened without cracking."

Said I: "These must crack sometimes. If you heat them improperly, why won't they crack as well as the American steel?"

"Well, they don't; I have had twenty years of experience with this steel, and I never knew a piece of it to crack in this place."

It was a double-ended affair, first one end and then the other being used. I begged one of the old pieces to experiment with in the matter of its wonderful capacity to stand any sort of heat for hardening. It was taken from a large lot of them, all from that wonderful steel with the long compound name. On arriving home I first thought I would break and examine the grain of this steel. Breaking the first end disclosed a crack! Breaking the other end showed four distinct cracks! "Twenty years of experience without seeing a crack!"

S. W. Goodyear.

Drawing-Room Economy.

Editor American Machinist:

The recent letters in the American Machinist, discussing drawing-room economy, have been of great interest, but there has been quite a diversity of views presented, and it is the purpose of this letter to try and give some of the most important points in question, in the shape of definite conclusions, "Tau" strikes the keynote of the whole matter when he says: "The office of the drawing-room is simply to conceive and make clear to the hands the necessary information to construct the machinery built by the shop."

Any system or lack of system which results in the failure to furnish such information is bad economy for the shop, although it may show up well enough in the drawing-room expenses. All agree that the first drawing made of a machine should be a general one, showing the machine with all its parts together as a completed machine. For drawing-room use, this need be only a pencil drawing, unless it is a very complicated machine, and the general drawing will always be needed in assembling the parts in the erecting shop. In such a case as that, however, it will be best to make the erecting drawing to a very much reduced scale and not put any figures on it, this being done so it can be kept with the detail drawings and be found when needed.

After the general drawing is completed, the next wanted will be drawings for pattern shop. Some advocate using the machine shop detail drawings for pattern makers, but the writer knows from experience that this does not usually pay. Give a pattern maker a detail drawing of an engine cylinder drawn to a scale of $\frac{1}{2}$ or $\frac{1}{4}$ size, and the first thing he will do will be to plane off a board and make a rude drawing, full size of cylinder, and then he is ready to commence work. Here it is clearly seen that he is doing that which could much better be done in the drawing-room. Therefore, it will pay to make pencil drawings for pattern shop, giving figured dimensions of all the parts, radius lines and length of same, indicate all surfaces to be finished by the word "finish" or letter *f*, and always make them full size if convenient. For simple patterns it is good economy to make a blue print from the machine shop detail drawing, and where extra figures are needed, they can be put on with red ink. The pattern shop drawings are only preserved until the pattern is proven to be correct.

A card with the following instructions should be given to each pattern maker:

Work to figures on the drawings in all cases, and where marked "finish," or with the letter *f*, make allowance of stock for finishing in the machine shop. Make your own allowance for draft and shrinkage.

Detail drawings for machine and blacksmith shops should be first made with pencil, and traced directly from that on tracing cloth, and from this blue prints made for use in shop. Make forging drawings plain, with as few sections and dotted lines as possible, and mark all the dimensions in figures. Where surfaces are to be finished, mark with the word "finish." Mark on or near each piece shown, the name of the material it is to be made of. Instructions to blacksmiths should be: Work entirely by the figures on the drawing, except where you find the word "finish," allow enough extra stock to finish up in the machine shop.

In detail drawings for machine shop, make sectional views only when necessary to give interior dimensions. Use as few dotted lines as possible. Figure dimensions only where parts are to be finished. Where parts are to be finished or polished to no particular size, simply mark it "finish" or "polish." Mark the manner in which holes are to be finished; whether drilled, reamed, bored or tapped.

Instructions to machinists should be: Do not finish any part not figured unless you find the word "finish" or "polish." Tap all holes marked "tap" with U. S. standard taps unless otherwise marked. Make all holes standard size, and vary the fit by varying the size of the piece fitted in. Where a hole is to be drilled and no distance is given, it is to be either marked from some other pieces, drilled by a template, or drilled in the center of a boss.

Some system of keeping the drawings so they can be found easily when wanted is a necessity, but all the elaborate systems of lettered and numbered drawers and indexing arrangements which the writer has seen, were made necessary by the fact that many different sized detail drawings were used. The question then arises: Is it necessary to have more than one size drawing for either shop or office use? The writer knows of one machine tool shop, and one engine building shop, where for several years they have used only one size of drawing, with entire satisfaction. There is no real good reason for having more than one size, where all the required dimensions are put on in figures, for the drawing can be reduced to a size that will come within the limits, and it takes but little more room for the figures on a large machine than on a small one. By the adoption of one size only, the drawings can be kept by the natural method of keeping all the drawings of one size of machine together in a drawer that fits them, and that has the title and size marked on the outside. There is no other system in use as economical of space for storage of drawings, or in which the drawings can be as quickly found when wanted.

B. Crank.

"Working Loose"—Jar and Vibration—American vs. English Steel.

Editor American Machinist:

It seems to me that "Jarno," in your issue of March 7th, is laboring under an easily explained difficulty, if I understand correctly. In his Fig. 1 the stud *B*, carrying gear *G*, has right-hand thread on end *T;* the gear runs to the right, thus, so far as friction is concerned, the tendency is to tighten the screw, which it undoubtedly would do were it subjected to a constant and steady strain, or, in other words, were the action continuous, which it is not. The hammer-like blows of the cutter, as each tooth strikes the work, takes it in reverse of the friction with a sudden, sharp impingement of that portion of the gear's surface closest in contact with the body of the stud (which point would depend upon circumstances), driving it back precisely the same, only to a less extent, as a hammer and set would.

His remedy lies in running it the other way, or cutting a left-hand thread upon the stud.

Jarno is right; jar and vibration do indeed cause no end of trouble and annoyance. Eight miles north of this place is the great dam at Holyoke, and so great is the vibration caused by the water flowing over it, at nearly all times of the year—notably during medium high water—that windows in this city facing the north, especially if hung by weights, will thump continually, about two or three thumps per second, causing no little annoyance.

Richmond Viall's views upon the steel question coincide with my own on the relative merits of English and American steel. I have for years been working and studying steel, and my experience is that, for uniformity of quality and reliability, Sheffield steel is far superior to American steel. That as good steel can be made here as anywhere I do not question, but that our manufacturers do not do it, I am and have long been satisfied. Whether they do not use the proper material in proper proportions or whether they do not take plenty of time and care to thoroughly mix the materials I do not know, but that it lacks uniformity I do know. I have taken two pieces from the same bar, subjected them to the same treatment, as nearly as possible, throughout the making of two tools exactly alike, and the result would be wholly unlike. I have seen so-called tool steel which would take nothing but a case-harden skin deep, try as I might.

A. E. Todd.

Springfield, Mass.

"Working Loose."

Editor American Machinist:

Let me say a few words regarding that intermediate gear stud that was ever jarring loose, as spoken of by the author of Shop Notes, No. 14, in your issue of March 7th.

He says it is more apparent when we remember that the friction of the gear on the stud has a tendency to screw it home. I take it the gear was used to transmit power to a milling machine cutter. If that is the case I cannot agree with him. I think the greatest friction the stud is subject to has a tendency to unscrew it. He says the jar is caused by the cutter teeth striking and leaving the work. Now, when the cutter tooth leaves the work there is a quick rebound; now isn't there more friction brought to bear on the stud at that time than at any other?

J. B. L.

Cost of Oiling a Cylinder.

Editor American Machinist:

I saw in a recent issue of your paper the cost of oiling an engine cylinder.

Where I am, one pint of oil lasts two days, the engine being 18″x24″, running 160 revolutions, in a rolling mill. The boiler pressure is from 100 to 115 pounds.

David McGary.

Want to Know.

A correspondent writes us:

Will some of your readers tell me how to make a wood pulp digester, using alkalies at high steam pressure, so it will not leak? I have never experimented with such a boiler, but I am told it is a difficult matter, and now I find it desirable to know more about it.

Another correspondent writes:

We have some steel plates $\frac{1}{16}$ inch thick, two inches wide, and four inches long, which we harden for half their length, leaving the other half soft. They come out warped, and often cracked. Can any reader of the American Machinist tell me how to harden them satisfactorily?

Still another correspondent is desirous of finding the best plan to pursue in soldering aluminum.

The Inman steamship "City of New York," which it was expected would be the fastest trans Atlantic steamer afloat, but which did not in the four trips she made equal the expectations of the designer, has resumed her trips, after being laid up for some months. In the interval the two steel propellers have been removed and manganese bronze propellers substituted, apparatus for making 80 tons of fresh water per day has been added, and several minor improvements made.

That was a very remarkable occurrence which took place at Birmingham, Pa., a few days ago. A limited express train on the Pennsylvania Railroad was running at the rate of thirty-five miles an hour and the engine broke a spring frog, displacing about fifteen feet of rail. The cars ran over this gap on the ties and every wheel mounted the rail again, no damage being done more than a shaking up of the passengers.—*The Star.*

Iron says: Persons who are annoyed by a creaking door do not always have oil at hand, or do not care to use it, for fear of soiling the hands and the woodwork. But nearly everybody carries a lead pencil. If the hinges are rubbed with the point of a pencil the creaking will cease, graphite or plumbago being one of the best known lubricants.

The Milling Machine and its Operations.

By A. B. Landis.

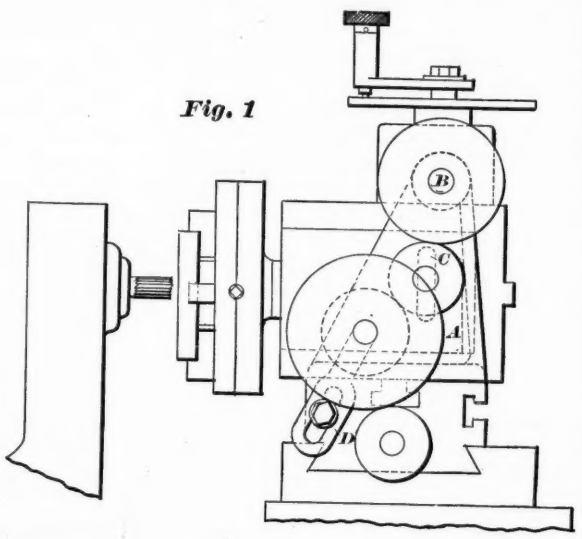
No. 3.

The universal milling machine dividing head, as used on nearly all machines of that type, would seem to present little room for improvement. It does when we want to use it only in the ordinary manner, as its construction admits of the most accurate dividing, provided its original conditions are maintained. But there are very often operations of milling that the dividing head as applied will not admit of doing, and consequently it does not bear out its name, "Universal."

I have frequently had jobs of work to do, in which it was necessary to have the chuck face the spindle of the machine, and have it geared to the screw, as in the case of cutting spirals, for instance, or a scroll gear either flat on face, or conical. It will be seen that the dividing head as now used on nearly all Universal milling machines is not adapted for this kind of work.

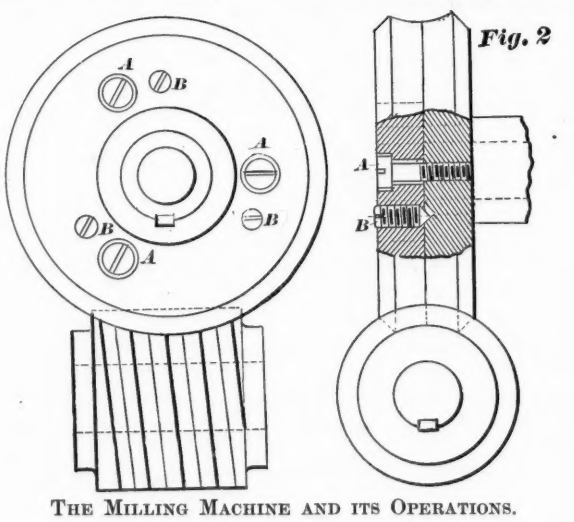
I improvised a plan for cutting a scroll which cost very little to make, and is shown in Fig. 1. I made a stand *A* and bolted it to the end of the platen, where the dividing head is usually used, and bolted the head on its side on the center of the platen, upon parallel pieces (not shown in drawing), for the purpose of the bolt head escaping the platen. A shaft *B* connected with the shaft in head, with its other end supported in a bearing on the upper end of the stand *A*. A slot *C* receives a stud upon which is mounted an intermediate gear, the ordinary bracket stud (as used on the Brown & Sharpe machine) *D* being fastened at its usual place on the end of the platen, by which means the usual compounding of the gears can be made, the intermediate stud in slot *C* being only used to make the connection to the top. It will now be seen that a scroll on the face of a plate can be readily cut of any pitch and at any angle desired by swinging the head around to any degree, by the same means it is swung up and down when in its regular position. To make a more complete job of this a neat base could be made to fasten the head to, instead of the parallel pieces, which would only justify the doing in case of considerable work of the kind to be done. This arrangement does not make a neat appearance, but it answers its purpose well.

Fig. 1



With reference to accurate dividing, I have already said that the construction of most dividing heads admits of it, for the reason that a worm gear is used and the index is placed upon the worm shaft, thus relieving the index pin of the strains it would get with the index plate mounted on the spindle, and also admitting of a greater number of divisions to be made from the same index plate, and also make more accurate work, provided an accurate worm-wheel has been made. A good dividing head of this kind is the one only which has no lost motion in any of its parts, and to avoid lost motion ample provision for adjustments should be made in all its parts. The worm and worm-wheel is quite susceptible to wear, and hence lost motion, and when this once occurs no dependence for accurate dividing can be placed upon the machine. To overcome the trouble, the parts must be brought to original conditions. Brown & Sharpe make the worm-wheel in their dividing head in halves, and fasten them together with three screws. In their treatise on the milling machine they state "making it capable of adjustment," but they do not provide the means therewith, nor state how it might be satisfactorily accomplished.

Fig. 2



THE MILLING MACHINE AND ITS OPERATIONS.

I will here give my method of adjusting it (which likely is their plan also). I took the wheel apart, enlarged the holes in the one half—as well as the counter sunk portion—to make room for the bolts *A*, *A*, *A*, Fig. 2. I then put it together again and shifted it around as far as the bolt would permit, and fastened them, then I bored holes to receive the screws *B* through the one half, and counter sunk the other half to receive the point of the screw. Now by loosening the screws *A* and having the worm and worm-wheel in place in the head, with the cap removed, draw up the screws *A* just sufficient to allow the two halves to slide over each other (not freely), then adjust the three screws *B* until the worm will engage the worm-wheel without any play. Then securely fasten the screw *A*, and the adjustment is complete. Now it is in readiness for quick adjustment at any future time, and will allow of many adjustments thereafter, and an accurate dividing head be maintained at all times. Whether all manufacturers of milling machines have made this provision in the worm-wheel as stated, I am not aware; but if not, the remedy is not quite so clear as in this case.

It is obvious that this worm-wheel is now susceptible to more wear than before, since it has only one-half of the bearing surface; but this presents no argument against it.

In cutting gear-wheels this lost motion will be found exceedingly objectionable, owing to irregular spacing.

Before adopting the method here described, I helped the case by using a face plate, screwed on the spindle of the head, and applied a strap over its edge, fastening it with a screw, and suspending it over the sides of the platen, and applied a weight, and thus kept the lash all in the same direction. But in the case of cutting steel or wrought gearing (or any other similar work) it failed to produce good work—chiefly for the reason that the gear-cutting miller has so little side clearance, that cuttings, lodging on either side of the miller when coming in contact with the side of the gear-tooth, will thrust it from one side to the other, and make very rough work. This is also true, however, to an extent, with a closely adjusted dividing head, since the arbor holding the blank to be cut will spring.

To make smooth work in cutting wrought-iron or steel gearing, when the entire cut is made at once, and oil is used, some means for brushing or washing the cutter should be employed, else smooth work cannot be the result. To cut them dry is very hard on the milling cutter, especially so since the side clearance is so little. The best results, no doubt, are obtained by roughing out first and finishing with a very light cut without oil.

The citizens of Kansas propose to deal with the question of trusts before they are afflicted. To this end, the legislature has passed a law making trusts unlawful, and providing penalties for those who attempt to establish them. This will be a good thing if carried out, but, judging from the past, the trusts may be depended upon to take care of their own part of the business, legislation included.

Tobin Bronze.

Tobin bronze is the name of an alloy which is being put on the market by the Ansonia Brass and Copper Co., 19–21 Cliff street, New York, and 133–135 Wabash avenue, Chicago. The peculiarities of this metal are high elastic limit, great strength, toughness, and uniform texture.

It can, when heated, be forged and stamped as readily as steel; it is dropped forged for parts of machinery subject to corrosion, and where greater strength than that of brass or bronze castings is desirable; in fact, its great strength makes its use desirable in hundreds of instances where corrosion is feared; as for example for pump and piston rods, condenser plates, glands, bolts and nuts, propellers and propeller shafts for yachts and launches, etc.

It is also said to make very superior springs, either from wire or rolled plates. It works well in the lathe, and finishes a bright gold color. Its specific gravity is less than that of copper, which is of considerable importance when used for ship sheathing and fastenings, and in fact for any purposes about ships and boats.

As of interest to those using bronze, we give the results of tests of this metal, both cast and hot rolled. It should be noted that variations are made in the mixture to suit the conditions under which it is used, and that some of the records of tests show even greater strength than any given below:

Record of Test by Tensile Strength of (Cast) Tobin Bronze, by Professor Robert H. Thurston, Ph. D., A. M., C. E.

Dimensions: Length=5″ Diameter=.798″

Load per Square Inch.	Elongation.	Set.	Elongation in per cent. of length.
Pounds.	*Inches.*	*Inches.*	
300	.....	.....	....
1,000	.0012	.....	.024
2,000	.0022	.....	.044
2,200	.0024	.....	.048
2,400	.0026	.....	.052
2,600	.0028	.....	.056
2,800	.0030	.....	.060
3,000	.0032	.....	.064
3,200	.0034	.....	.068
3,400	.0036	.....	.072
3,600	.0038	.....	.076
3,800	.0041	.....	.082
4,000	.0044	.....	.088
5,000	.0054	.....	.108
6,000	.0064	.....	.128
7,000	.0074	.....	.148
8,000	.0081	.....	.162
9,000	.0088	.....	.176
10,000	.0095	.....	.190
300	.....	.0022	.044
10,000	.0113	.....	.226
12,000	.0125	.....	.25
14,000	.0137	.....	.274
16,000	.0150	.....	.30
18,000	.0165	.....	.33
20,000	.0176	....	.352
22,000	.0189	.....	.378
24,000	.0202	.....	.404
26,000	.0213	.....	.426
28,000	.0226	.....	.452
30,000	.0240	.....	.48
32,000	.0254	.....	.508
34,000	.0268	.....	.536
36,000	.0282	.....	.564
38,000	.0297	.....	.594
40,000	.0313	.....	.626
300	.....	.0150	.030
10,000	.0215	.....	430
20,000	.0279	.....	.558
30,000	.0345	.....	.690
40,000	.0399	....	.798
42,000	.0423	.....	.846
44,000	.0447	.....	.894
46,000	.0473	.....	946
48,000	.0494	.....	.988
50,000	.0527	.....	1.054
52,000	.0568	.....	1.136
54,000	.0615	.....	1.23
56,000	.0674	.....	1.348
58,000	.0771	.....	1.542
60,000	.0873	.....	1.746
62,000	.0958	.....	1.916
64,000	.1277	.....	2.554
66,000	1577	.....	3.154
67,000	Broke.		

Tenacity per square inch original section, 67,600 lbs.
Tenacity per square inch fractured section, 73,160 lbs.
Diameter fractured section, 0.767″.

TEST BY PROFESSOR DENTON.

Samples of your hot rolled Tobin bronze, prepared from a ⅞ inch cylindrical rod, gave the following results when tested under torsional strain, in comparison with similar samples cut from a ⅞ inch rod of the toughest grade of machinery steel. The steel used for this comparison combines the greatest tensile strength with the maximum of ductility.

Its tensile strength is 94,550 pounds and its stretch 36.44 % in 4½ inches length of specimen, having a diameter of five-eighths of an inch.

J. E. DENTON, *Prof. Experimental Mechanics.*

MARK.	LAB'Y NO.	MATERIAL.	DIMENSIONS OF SPEC'N TWISTED. Length.	Diam'r.	LOAD AT END OF ONE FOOT LEVER. Which strained Samples to Elastic Limit.	Which Ruptured Samples.	TWISTING IN DEGREES. At Elastic Limit.	At Point of Rupture.
	3984	TOBIN BRONZE	1 in.	.500	325 lbs.	660 lbs.	2.75°	78.°
	3985		"	.498	340 "	625 "	2.5°	108.°
	3986		"	.498	320 "	615 "	2.75°	90.5°
	3987	MACHINERY STEEL	"	.497	330 "	710 "	1.6°	287.°
	3988		"	.498	350 "	700 "	1.75°	325.°
	3989		"	.498	340 "	725 "	1.°	327.°
		Average for Bronze,			328 "	633 "	2.67°	92.2°
		Average for Steel,			340 "	711 "	1.45°	313.°

Fairbanks' Testing Machine. Department of Tests and Experiments, N. O. Olson, Engineer, 84 Thomas St., New York, Dec. 11th, 1888. Report of Tests made for Ansonia Brass and Copper Co.

Source		Ansonia Brass and Copper Co.		
Material		Hot rolled Tobin bronze.		
Mark		1	2	3
Test No		6491	6492	6493
Shape, original, 1 in. round bars.				
Dimensions. Final. Original.	Length, inches,	8 in.	8 in.	8 in.
	Diam., inches,	.645	.641	.645
	Area sq. inches,	.327	.323	.327
	Length, inches,	9.36	9.30	9.12
	Diam., inches,	.518	.500	.509
	Area sq. inches,	.211	.198	.204
	% Elongation,	17.00	16.25	14.00
	" Reduction,	35.47	38.70	37.61
Stress in lbs. Tension. Per sq. Inch. On Specimen.	Elastic Limit,	17,000	18,000	18,000
	Maximum....	26,060	25,720	25,850
	Elastic Limit,	51,990	55,730	55,050
	Maximum.. .	79,700	79,630	78,900
	Fracture... .	Very Good.		

REMARKS.

In regard to your request to express my opinion of the Tobin bronze, will say that it is far superior in point of strength to any bronze or metal of that kind I have ever tested. N. O. OLSON, *Eng'r.*

Tests for resistance to corrosion were made by Robert B. Hine, Chief Engineer U. S. Navy, Senior Inspector. Immersed for twelve days in a strong decoction of oak bark, used in tanning leather, the specimen was found unchanged; the same was true when the specimen was immersed in "sweet water" from a sugar refinery.

Kept twelve days in a mixture of one-half sulphuric acid and one-half water, the specimen lost in weight less than $\frac{1}{1000}$ of one per cent.

According to the State Agricultural Bureau of Michigan, after deducting the cost of producing an acre of wheat in that State from the pirce realized from its sale, the profit is $4.21. Those who have exaggerated ideas of the profits of farming can easily figure that it would take some time to get rich raising wheat on a small farm.

It is said that American wheat and corn can be bought in quantities cheaper in Europe than in New York, and New York brokers claim this is due to railroads discriminating against the city in the way of freights. New York, so the brokers say, is slowly losing its export trade.

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NEW YORK, MARCH 21, 1889.

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Subways for the Pipes.

With the growth of New York city and the multiplication of the various pipes laid under its streets for carrying water, steam, gas and sewage, and with the recently added electric wires and cables, it is becoming daily more apparent that the time will come when it will be absolutely necessary to provide a better means of doing such work than simply to dig up the street, lay the pipe or cable, cover it up again and trust to luck for its continuous satisfactory operation.

That luck does not keep such things working in a satisfactory manner is abundantly proven by the constant and chronic state of eruption in which many of the streets are kept by the ever-recurring necessity of digging down to repair some leak or remove some obstruction. The digging done for such purposes, together with that which must be done every time some new pipe or wire is to be laid, constitutes a serious obstruction to traffic in what are already overcrowded streets.

Then explosions under the streets add to the list of annoyances and dangers to which the pedestrian is exposed, and he knows not at what moment the paving stones may rise up under his feet or a heavy manhole plate descend upon his head.

It seems to us that there is but one remedy for this state of affairs, and that is to construct a walled and arched subway of stone or brick large enough to contain all the necessary pipes, wires and cables of every kind, and also to admit of the necessary work of repairing or laying new systems to be carried on comfortably within it.

Of course such a thing would be very expensive, but most desirable things are expensive, and it is much to be doubted if this in the end would cost more than the continual digging and re-digging that is forever going on now. And the expense of such a subway could be divided among the various companies using it in proportion to the benefits received, and need not fall with unbearable weight upon any of them. With such a subway once provided, a great deal of expense which must now be borne would be permanently done away with, and the public saved a vast amount of inconvenience and actual danger. Pipes could then be as well taken care of as in a well-regulated engine room. Leaks could be promptly discovered and as promptly repaired; in short, it could be made safe, clean, economical, and in every way satisfactory, instead of the opposite, as the present plan is daily proven to be. We do not expect such a plan to be adopted until something compels it, but we believe that eventually some such thing will become a recognized necessity in this as well as others of our large cities.

A Trio of Enterprises.

At this writing it seems probable that the great copper combination will, in a short time, go to pieces. It has for some time been evident that the world is too large to be cornered by such a combination of legalized robbers, and that sooner or later the anxiety of those who could place copper upon the market in any part of the civilized world, to do so as rapidly as possible at the high prices fixed by the syndicate, would finally overwhelm the Frenchmen, and sweep away the barriers placed by them for the purpose of obstructing the natural flow of trade, and levying blackmail upon all consumers of copper.

It is a pitiful commentary upon our laws for the regulation of such matters, that a company of foreign adventurers can dictate, even for a single day, the terms upon which American citizens shall be allowed to use the product of their own copper mines.

But, while the French copper syndicate seems to be on the decline, there are two other piratical organizations which, just at this time, seem in an unusually prosperous condition, and to be meeting with great success in their efforts to get a firmer and more deadly grip upon the industries and commerce of the country.

The Standard oil monopoly is quietly buying up oil and gas-producing territory, with the evident intention of getting absolute control of the sources of production, and, unless something occurs to interrupt its course, it looks as though its past operations in the way of crushing out legitimate competition, and setting aside the ordinary laws of business, will be as nothing compared with what it will do in the future, when its title deeds, leases and franchises cover sufficient territory to enable the screwing down process to be carried on safely.

The fact that our deposits of anthracite coal are confined to a comparatively narrow strip of territory has enabled the coal monopoly to attain that apparently safe position already, and the results are seen in the unreasonable and exorbitant prices charged for coal, which lay a heavy burden upon manufacturing operations, and inflict untold suffering upon thousands of poor families who are unable to pay for enough of it to secure any degree of comfort during our severe winter weather. The monopolistic control of this necessity of the people is strengthened by the further fact that the same men who own most of the coal lands own also the only railroads over which coal can be brought to market, though the laws of Pennsylvania are intended to prevent such double control.

A recent press dispatch says that much fear is felt lest many of the miners and their families in the anthracite regions will starve, and suffer other forms of deprivation and want, because these dispensers of God's bounties have chosen to shut down the mines, in order to keep the price of coal far above the point at which the natural and free action of the law of supply and demand would place it.

When the miner is permitted to labor, he works in open competition with the laborers of the world who may freely come and underbid him, and he is robbed in pluckme stores, in the prices charged him for blasting powder, by the system of docking, and in the rent of the hovel in which he is supposed to live! And all this, not that coal may be cheap to the consumer, but that a few men, whose operations are a greater menace to the security and permanence of our republican institutions than long-haired anarchists, may pile up worse than useless wealth.

John Ericsson.

The more the recently completed life and work of John Ericsson is contemplated, the more remarkable and praiseworthy it appears. Not only his wonderful fertility of invention, his vast and intimate acquaintance with physical laws, and the ingenuity which he displayed in bringing them into the service of mankind, but his unflagging industry, his modest and retiring disposition, his remarkable freedom from the greed for praise and glory and wealth, marked him as a man among ten thousand, whom, in honoring, mankind honors itself.

Calling at his unpretentious residence on the day of his death, we were ushered into what answered as his parlor. This room, instead of being filled with rich furniture and works of art, or with gaudy trappings such as are usually considered necessary in such an apartment, contained nothing but a few chairs and a center table, while around the room were other tables which contained a great number of beautiful models of his inventions, most of them carefully protected by covers of glass. It is true these models had cost much more than the finest furniture and fittings could have cost, but to most people these would have been a poor and unsatisfactory substitute. Yet to Ericsson they were far more interesting, more beautiful and more companionable, than any thing else could have been. In that part of the room where the finest picture would naturally be looked for, hung an engrossed copy of the resolution of thanks passed by the legislature of New York immediately after the naval battle in Hampton Roads, which demonstrated that his genius had saved a nation, and made necessary the rebuilding of the navies of the world. The furnishing of this room is an excellent index to the character of the man. Caring nothing for mere display nor for luxuriance, his whole life and thought were entirely devoted to the work for which nature evidently intended him. Those who hold that a man's achievements on earth are dependent mainly upon the amount and persistence of his labor will find abundance of evidence that in him there was a remarkable natural talent or genius, without which he could not have accomplished nearly so much; while, on the other hand, those who claim that from natural abilities or genius come the greatest and most beneficent results will find that John Ericsson's fame rests as much upon his ability and willingness to perform hard and continuous labor. He possessed to a remarkable degree the power to labor, coupled with the genius necessary to direct that labor and make it fruitful of good to mankind. We do not now recall a single name associated with so many important and notable inventions, any one of which would have made him famous and secured for him an honorable place in history. And the name of John Ericsson has never been connected with a single scheme for making money at the expense of others. What little money has been received by him, or others who have had anything to do with his inventions, has been honestly earned and immeasurably more than full value given for it.

His invention of the screw propeller alone conferred a benefit upon commerce, and gave an impetus to civilization, the value of which it is impossible to compute, and ages hence, when our coal beds shall have become exhausted, it is not unlikely that his latest work on the problem of converting the sun's energy directly into motive power will point out to humanity the way to prevent its own extinction.

The final ceremonies designed to do him honor were held in old Trinity, and it is safe to say that of the long list of heroes and great men whose funeral services have been held there, none have conferred greater benefits upon their fellow-men or have accomplished a more noble and enduring work than John Ericsson.

Literary Notes.

THE PRINCIPLES OF THERMO-DYNAMICS. With Special Applications to Hot Air, Gas and Steam Engines. By Prof. Robert Röntgen. Translated, revised and enlarged, by A. Jay DuBois, Ph. D., Professor of Dynamic Engineering in the Sheffield Scientific School of Yale College. Second edition.

This work treats of the mechanical effects of heat, and of those mechanical processes by which heat is generated. The work is divided into two parts; the first part gives general principles, and also treats of Hot-air and Gas Engines. This part is preceded by two lectures of Prof. Verdet, on the mechanical theory of heat. These lectures are highly interesting and instructive. They form, with the notes and additions, an admirable summary of the whole field, and serve well as an introduction to the work. The second part treats of Heat, Steam and the Steam Engine. The present edition has been thoroughly revised, and many additions of great value have been made. Numerous practical examples are also given with the reduction and heat tables for their rapid solution. It may be said that in this work two courses are presented, one with and the other without the aid of calculus. The first six chapters of Part I and Part II form by themselves a short elementary and practical course. The steam tables of Zeuner, at the end of the work, are given complete, both in their original French units, and also reduced throughout to English units. It is one of the best works on this subject that we have seen, and we can highly recommend it. The presentation of the subject is simple and natural, and particularly well suited to students unfamiliar with the subject; and since it is not absolutely necessary to master the chapters in which the application of calculus is made, it may be said that this work is also suitable for beginners who are not acquainted with many of the higher branches of mathematics, demanding of them only a knowledge of algebra, and the simple principles of mechan-

ics. This work is not only a text-book, but its arrangement is such as to make it serve as a book of reference as well, and point out the method to be pursued in the investigation of any problems which may occur in future practice. The author's effort throughout the book has been to aid both teacher and student in their work, and to impart such a knowledge of the subject as shall render it practically serviceable. The book contains 703 pages and 103 wood-cuts. It is published by John Wiley & Sons, 15 Astor place, New York. Price, $5.00.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(127) S. W. B., Kansas City, asks: What is the standard taper for the screw joints in oil well drills? *A.*—These joints are patented; the manufacturer declines to give us the information asked for.

(128) J. H., Yonkers, N. Y., who asks the old questions in regard to a cannon-ball fired from a moving train, will find the whole matter explained on page 5 of the AMERICAN MACHINIST of June 2, 1888.

(129) H. D., Ontario, asks: Has the engine with drivers said to have 102 flat places on the tread been a success? *A.*—We have not heard of its success. 2. Does an injector work with air pressure? *A.*—No.

(130) W. D., Cincinnati, Ohio, writes: Please explain the method of finding the chord and height of the arcs in the development of a frustum of a cone, such, for instance, as taper courses in boilers. *A.*—See answer to Question 306, in our issue of June 23, 1888.

(131) A. E., Scranton, Pa., asks: What size and kind of pump would you recommend to pump air out of a tank 8 feet by 10 feet? If possible, let me have the name of a firm manufacturing the same. *A.*—You do not give us sufficient data required for determining the size of pump. Many manufacturers of steam pumps also build air pumps. Write to any one of these.

(132) B. J. S., Philadelphia, Pa., writes: I am building a small engine whose stroke is 3½ inches. What should be the length of crank from center of shaft to center of crank-pin? *A.*—In all ordinary engines the length of crank is always equal to one-half of the stroke, hence in your case it should be 1¾ inches. 2. Please give rules for finding the throw of the eccentric, and travel of valve; or recommend a book in which these problems are worked out. *A.*—See page 2 of our issue of Oct. 10, 1885.

(133) G. R. W., Hinsdale, N. H., writes: We have a portable engine and boiler. Engine, 10x16 inches, 150 revolutions per minute, steam pressure, 100 pounds, cutting off at ¾ stroke. What is the horse power? *A.*—We should rate the engine at 48 I. H. P. 2. The boiler is 8 feet long; 48 two-inch flues; fire-box. 5 feet by 2½ feet; locomotive type with water bottom. What is the horse power of the boiler? *A*—We cannot tell, because you have not given the length of tubes, neither have you given the height of the fire-box.

(134) A. K. B., Philadelphia, Pa., writes: We are using bituminous coal under a battery of twelve boilers, under which must be kept hot fires both day and night while in service. The coal clinkers, and fastens on the fire-box walls, so that in punching it off with the slice-bars, the fire-bricks are soon punched through. Do you know of any way to prevent clinkers? *A.*—The formation of clinkers cannot be prevented. We are informed that the clinkers can be prevented from sticking to the fire-bricks by mixing fire-clay and black lead in water, and applying with a brush to the surface of the walls.

(135) G. S., Milan, Italy, writes: A bathing establishment has four externally fired vertical boilers, 4 feet diameter, 8 feet long each, for heating the water used in this establishment, and a suction and a force pump worked by a 1½ horse-power gas engine. The intention now is to use the four old copper boilers as tanks, do away with the old pump and gas engine, and purchase a first-class steam boiler with a steam pump. Part of the steam generated in the new boiler is to lead through coils of pipes in the four old copper boilers for heating the water, and the other part of the steam is to be used for working the steam pump. 4,350 gallons of water per hour will have to be raised by the pump, through a total height of 37 feet. Of this amount of water, 1,350 gallons must be heated to the boiling point every hour. I now want information as to how the plant must be executed. 1. What should be the grate, heating surface, and working pressure of the boiler? *A.*—Grate area, 15 square feet; heating surface, 450 square feet; steam pressure in boiler, about 60 pounds. 2. Size of injector for feeding the boiler. *A.*—Injector should discharge about 300 gallons per hour. 3. Size of steam pump to raise 4,350 gallons per hour. *A.*—Steam cylinder, 5½ inches diameter; water cylinder, 5½ inches diameter; stroke, 7 inches. 4. Size of coil in tank. *A.*—The total heating surface of the coils in all the tanks should be about 500 square feet.

(136) C. S., Cincinnati, Ohio, asks: 1. Is there any issue of your paper that explains the setting of the valves of automatic engines with governors? *A.*—Yes; see our issue of February 27, 1886. 2. Why are locomotive links suspended out of the center horizontally? *A.*—To secure an equal cut-off. 3. What is the cost of a good steam engine indicator? *A.*—Write to the makers. 4. How much do engineers generally charge for applying the indicator and making test? *A.*—That depends on the standing of the engineer in his profession, and other circumstances. 5. Can you describe the brake used to determine the power of an engine? *A.*—See illustration in our issue of March 8, 1884.

(137) A. B. C., Middletown, Ohio, writes: Please tell me what is the trouble with my engine; it is a Corliss engine, 16x42 inches, and built for about 115 horse-power, but we are only working her up to 45 horse-power. There is a constant rattling in her exhaust valves; is this caused by the comparatively small load on the engine? How can I remove the cause of rattling? *A.*—It is impossible for us to trace the cause of the rattling unless we see the engine. It may be that the valves have become too loose through constant wear, and may have to be replaced by new ones. The comparatively small load on the engine has a tendency to increase the rattling of loose valves. A good machinist, accustomed to repairing Corliss engines, will easily trace and remove the cause of your trouble.

(138) C. S., Cincinnati, Ohio, writes: In an engine builder's catalogue I find the following statement: "Where engines are used condensing, a wide-faced wheel adapted to the belts required will be furnished." I don't understand this. *A.*—Probably the engines made by this firm can be worked either condensing or non-condensing; for the former, a separate condenser may be furnished. If such is the case, the engine when worked condensing will develop more power running at the same speed than when non-condensing; hence, it will require a wider belt to transmit the increase of power. 2. Will an engine develop as much power when cutting off at ¼ stroke as at a later cut-off? *A.*—No; but at the early cut-off it may use the steam more economically. 3. Will the length of a boiler have any effect on its draught? *A.*—Yes, but only to a slight extent, which in practice may be neglected. 4. How can leaks around the rivets be repaired? *A.*—By calking, provided the rivet and plate are sound. 5. What is the strength of a triple-riveted seam as compared with a solid sheet? *A.*—That depends on the workmanship and material used. The strength of the seam may be equal to from 80 to 90 per cent. of that of the solid sheet. 6. What is the most practical method of leveling a line for putting up shafting? *A.*—To bring the bearings in line in a vertical direction, use parallel straight-edges and spirit level. To place the bearings correctly in a horizontal direction, use a common line.

(139) T., ———, Pa., writes: Suppose I have two 9x12 inch engines alike in every part excepting the connecting rod; in one it is 3 feet, and in the other it is 2 feet 6 inches long. Would there be a loss or gain of power in one over the other, both running at the same speed, and what other effect would there be? *A.*—The pressure on the slides and crank-pin will be greater with the short connecting rod than with the longer one; consequently, in the former case more power will have to be expended in overcoming friction, and less power will be available for performing useful work. On the other hand, the longer rod will be heavier than the shorter one; consequently, a greater power will have to be expended in giving motion to it than will be required for giving motion to the shorter one. Again, with the long rod the motion of the piston will be more symmetrical than it will be with the short one. Taking all things into consideration, the engine with the long rod will run smoother than the engine with the short rod, and the former will be capable of performing more useful work than the latter, although the difference will be small. Of course there is a limit in either direction of the length of a connecting rod; it will not work well if made too short, and the strength of the rod will be reduced if made too long. But in the two given cases we prefer the engine with the 3-feet connecting rod. It may be remarked that the manner of determining the pressures on the crank-pin and slides caused by the obliquity of the connecting rod has been explained in our issues of July 23 and August 6, 1887.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday for the ensuing week's issue

Gear wheels and g-cutting. Grant, see adv., p. 16.
Link-Belting and Sprocket Wheels.
Send for Catalogue of Link-Belting.
Over 50,000,000 feet of Link-Belt in use.
Link-Belt Engineering Co., Philadelphia and N. Y.

Special tool work. R. M. Clough, Meriden, Conn.
Shafting Straighteners. J. H. Wells, Tampa, Fla.
Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.
Conveying machy, etc. A. E. Jenkins, Scranton, Pa.
The Improved Justice Hammer. Williams, White & Co., Moline, Ill., manufacturers.
The best Upright Hammers run by belt are made by Jenkins & Lingle, Bellefonte, Pa.
Berryman Feed-Water Heater and Purifier. Benj. F. Kelley, 91 Liberty street, New York.
R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.
Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.
"Swift" Sight Feed Lubricator; no glass tubes; simple, reliable. Swift Lub'r Co., Elmira, N. Y.
Power measured with guaranteed Dynamometers. Franklin Van Winkle, 91 Liberty st., New York.
Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty st., N. Y.
"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.
Round Adjustable, Round Solid, and Square Dies, all sizes. Mfd. by S. W. Card & Co., Mansfield, Mass.
Fire Brick and Clay Retorts for all kinds of heating and melting furnaces. Borgner & O'Brien, Phila.
Ice and Refrigerating Machines, 131 sold, and all successful. David Boyle, 521 Monroe st., Chicago, Ill.
"How to Keep Boilers Clean." A 96-page book mailed free by Jas. E. Hotchkiss, 120 Liberty st., N. Y.
Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.
Brown & Sharpe Mfg. Co. have a line of machinery with S. A. Smith, 23 S. Canal st., Chicago, Ill.
For the latest improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.
Upright drills, improved, sizes 21″, 23″, 25″, 28″, 32″, 36″ swing; finely made and great capacity. J. E. Snyder, Worcester, Mass.
Engine lathes, hand lathes, fine tools, files and supplies for machinists and other metal workers. Frasse & Co., 92 Park Row, N. Y.
Split Pulleys at low prices and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.
Curtis Pressure Regulators. Curtis Return Trap. Curtis Damper Regulator. See March 7, p. 14. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.
"Curiosities of the U. S. Patent Office." A great book. Goes like hot cakes. 12 pp. pamphlet for stamp. *Get one.* W. C. Raymond, Syracuse, N Y.
Fine tools and supplies for machinists and other metalworkers. Get our prices before purchasing elsewhere. Montgomery & Co., 105 Fulton st., N. Y. City.
The Holly Manufacturing Company, of Lockport, N. Y., will send, on application, their pamphlet illustrating pumping machinery and reports of duty trials.
With my Vacuum System, Exhaust Steam Heating costs nothing for fuel; Live Steam Apparatus altered to Exhaust. Satisfaction guaranteed. Geo. A. Barnard, 15 Cortlandt street, New York.
W. H. Hoffman, consulting engineer, 108 Liberty st., room 3, N. Y. Mechanical engineering in all its branches, working drawings for the transmission of power by steam, water, air and electricity.
Contract work of all kinds executed promptly and on reasonable terms. Parties wishing grey iron castings in large quantities can make money by corresponding with Rawson Mfg. Co., Hornellsville, N.Y.
The Vance Lightning Flue Cutter is *the* tool for removing old flues from boilers and locomotives (will cut fifty an hour); sent on approval to railroad companies. Vance Tube Cutter Co., Geneva., N. Y.
Standard Drawings of Improved Corliss Engines; Non-Condensing, Condensing, Compound and Triple Expansion. New Valve Gear and Dash Pot; also all branches Mechanical Engineering. Conover & Co., 219 Market st., Newark, N. J.
Steam Boilers: Their management and working on land and sea. By Jas. Peattie. Practical facts from 30 years' experience. 230 pages, illustrated, 12mo., cloth, $2.00. Circulars and Catalogue of Books for engineers free. E. & F. N. Spon, 12 Cortlandt st., N. Y.
"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 15 Astor place, New York.
"Binders" for the AMERICAN MACHINIST. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton St., New York.
"Practical Drawing." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, should be closely followed by every student. They commenced with October 23, 1886 issue, and up to and including March 14, 1889 issue, 72 articles have been so far published. Copies containing these articles sent by mail to any part of this country or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.
"Modern Locomotive Construction." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, are attracting the attention of railway mechanics all over the world. Commencing with the June 27, 1885 issue, 87 articles have thus far appeared up to and including the March 21, 1889 issue. Copies containing these articles sent by mail to any part of the U. S. or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

MANUFACTURES

John D. Bellamy, Jr., will build a furniture factory at Wilmington, N. C.

The St. Louis (Mo.) Iron and Machine Works are adding new tools to their plant.

W. R. K. Sanford is interested in starting a boiler plate and sheet-iron works at Selma, Ala.

Henry Kleymeyer is interested in a company that will build a planing mill at Henderson, Ky.

The Kansas City, Springfield & Memphis Railway Co. will build shops 13x317 feet, at Springfield, Mo.

James Hunter & Son, North Adams, Mass., will make extensive additions to their foundry and machine shop.

The sum of $30,000 has been subscribed by the citizens of Spokane Falls, W. T., towards building a woolen mill.

The Mississippi woolen mill at Wesson, Miss., will put in additional machinery which will double their present capacity.

The Rogers Siberian Iron and Tinplate Co. has been incorporated at Chicago, Ill. The company proposes to make sheet-iron and tinplate.

We learn that the citizens of Beloit, Wis., have subscribed $10,000 and ten acres of land to be given to the Williams Engine Company if it will locate there.

A company is being formed in Wheeling, W. Va., to be known as the Lead-Coated Nail Manufacturing Company. The lead coating is a substitute for galvanizing.

The Enterprise Wood Working Company, Sheffield, Ala., has been organized, with a capital stock of $30,000, to turn out sash, doors and blinds and finish for buildings.

Hitchcock & Atwood, who recently bought out D. T. Libby's carding mill at Phillips, Me., will raise and enlarge the building and put in machinery for woolen manufacture.

Geo. B. Grant, Lexington, Mass., and 66 Beverly street, Boston, has issued a small pamphlet relating to his business of making gear wheels and cutting gears of all descriptions.

A company known as the Empire Water, Light and Manufacturing Company, has been organized at Cedartown, Ill., to build water-works, gas-works, electric light works and an ice factory.

A stock company, with William Holden as president, has been formed at West Valley, N. Y., to manufacture sash, doors and blinds, barrels, butter tubs, cheese boxes and other articles of wood.

The Chapman Valve Co. will in a short time begin an addition to its works at Indian Orchard, Mass. The proposed addition will be 140 feet long, one story high, of brick, and similar to the original building.

The Collins-Gibbons Mfg. Co., St. Louis, Mo., manufacturers of wire machinery and tools, write us: Our trade in the East is good. We shipped a machine last week to Brooklyn and another to Wallingford, Vt.

Rowley & Hermance, Williamsport, Pa., manufacturers of wood-working machinery, are putting on the market a double surfacer, with a capacity for 8-inch stuff. There are some novel features in the construction of the machine.

It is reported that the Louisville & Nashville Railroad shops will be removed from Bowling Green, Ky., to Memphis and Nashville, Tenn., the work being divided between these places. The reason for the removal is said to be high taxes.

The St. Louis & San Francisco Railway Co. are making extensive additions to their shops at Springfield, Mo. These comprise an addition to machine shop, 76x90 feet, a new boiler shop, 90x185 feet, a car shop, 90x256 feet, with L 75x150 feet; also a new boiler house and several other buildings.

The business of the Duquesne Forge, at Rankin station, heretofore conducted by the Miller Forge Company, Limited, has been transferred to the Duquesne Forge Company, by whom it will hereafter be controlled. The Duquesne Forge Company will hereafter control also the business of the Twin City Forge, at Sharpsburgh, which has been conducted by Smith & McKim.

The Business Men's Association of Ellsworth, Me., have concluded a contract with Burrell, Houghton & Co., of Rockland, Mass., by the terms of which the latter are to remove their entire shoe factory plant to Ellsworth, the association paying $25,000. Burrell, Houghton & Co. will build a factory, which is to become theirs at the end of ten years, provided their annual pay-roll shall average $75,000. Work is to commence at once and the building is to be completed by May 15.

The Robinson Woolen Company, South Windham [Maine], whose mill was burned a year ago last month, at a loss of $50,000, have their new mill well along, and expect to have it finished early this spring. It is a fine brick building, 120x53 and to be four stories. They will also build a brick picker house later, 40x40 and two stories. The new mill, like the old one, will be fitted up with all the latest improved machinery, and they propose to make it one of the best mills of its size in the country. The old mill had five sets of machinery and 80 hands were employed, and the new mill will start with the same and has room for an increase. They formerly manufactured flannels, suitings and repellants.—*The Industrial Journal.*

An Atlanta [Ga.] dispatch to the New York *Tribune* says: "The Cartersville Furnace Company, the Etowah Company and the Daisy Coal Company now constitute one corporation, under the name of the Etowah Land and Mining Company, with a capital stock of $1,750,000, with the privilege of increasing it to $5,000,000. The work will proceed through trustees until the charter is granted. The work on the furnace has been suspended pending negotiations, and the general plan will now be greatly enlarged, and as soon as the new plans have been fully agreed upon the work will be rapidly pushed to completion. The furnace is only the beginning of a series of mammoth enterprises contemplated by this and other companies. Senator 'Joe' Brown, and M. J. Seaver, of Boston, are at the head of the concern."

Machinists' Supplies and Iron.

New York, March 16, 1889.

Iron—American Pig.—No. 1 X Foundry, $17 to $18; Lehigh and North River brands, $17.50 to $18; No. 2 X Foundry, $16 to $17; Grey Forge, $15 to $15.50.

Scotch Pig.—Coltness, $21 to $21.50; Gartsherrie, $20; Summerlee, $20.50; Eglinton, $19 to $19.25; Dalmellington, $19.75 to $20; Clyde, $20.50; Langloan, $20.50.

Copper.—The probable collapse of the syndicate leaves prices in an unsettled condition, with a tendency downwards. It has been sold here during the past week at 14c.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted– See bottom of third column, page 11.

Wanted—A situation by a sober, reliable stationary engineer. Box 72, American Machinist.

Machine Shop Foreman wants charge. Contract if desired. Address Shop, American Machinist.

An experienced jobbing moulder desires a steady job; West preferred. 2 R., American Machinist.

Good all-around machinist, licensed engineer, wants responsible position. Smith, Am. Machinist.

Wanted—Bicycle Machinists and Assemblers. Must be first-class. The Smith Nat'l Cycle Mfg. Co., Washington, D. C.

A draftsman with a technical education and some good experience wants a position with some responsibility. Address Designer, American Machinist.

A first-class brass foundry foreman wants to change. Best of references. Address Sound Castings, American Machinist.

Wanted—After April 1st, position by strictly first-class mechanic as tool maker, where special machinery needs developing and constructing. Good wages required. Address Box 71, Am. Machinist.

First-class machinist and tool maker wants situation as foreman. Large experience on special tools for making light machinery. Terms reasonable; good references. Address "Grant," Am. Machinist.

Wanted—By competent man, position as superintendent, head draftsman or general foreman for machine shop and foundry; Washington Territory preferred; age, 40. Address Box 74, Am. Machinist.

A corporation manufacturing specialties desires a foreman; must be a thorough machinist, and must have a small amount of capital. Address Manufacturers, Box 316, Buffalo, N. Y.

Wanted—Position as foreman; 42 years old, 15 years' experience as foreman with automatic engines, elevators, mill work and general jobbing. Address Box 77, American Machinist.

Wanted—A first-class moulder, competent to superintend a foundry. Must have $5,000; a good salary will be paid to a first-class man. Address Box 78, American Machinist.

Young man wants position as assistant mech. draftsman, or to party erecting mills or laying out foundations for mach'y; understands using transit and level; reference. Box 79, American Machinist.

Wanted—A foreman to take charge of our automatic screw machine department, using forty or fifty screw machines. Address Ottumwa Iron Works, Ottumwa, Iowa.

Wanted—By practical brass and iron foundryman, a position as superintendent of some large manufacturing concern that wishes to improve the quality and reduce the cost of production. Address A. B., American Machinist.

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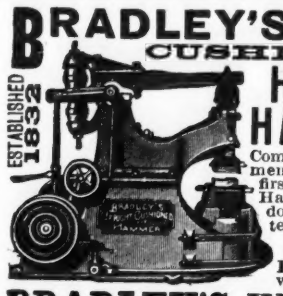

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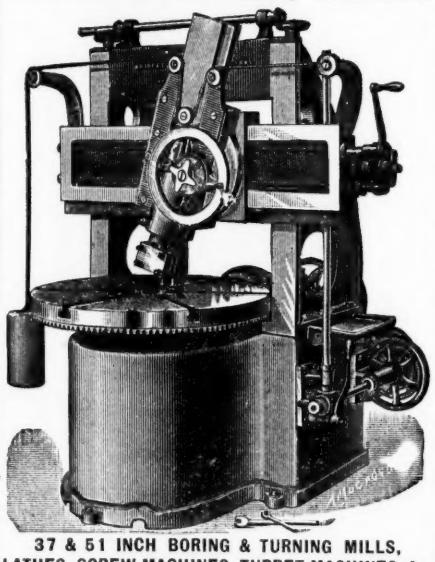

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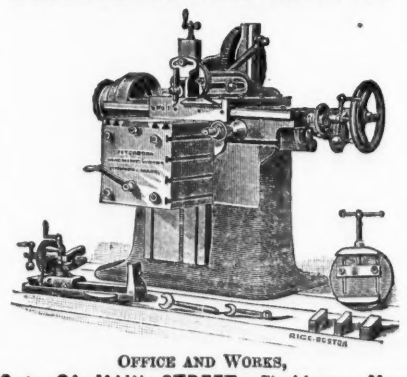

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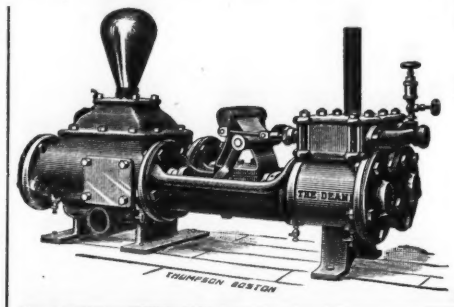

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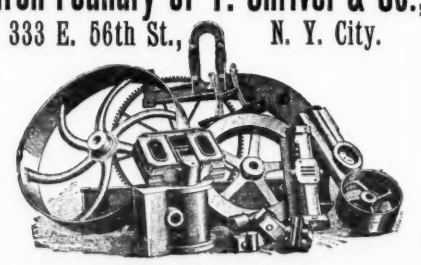

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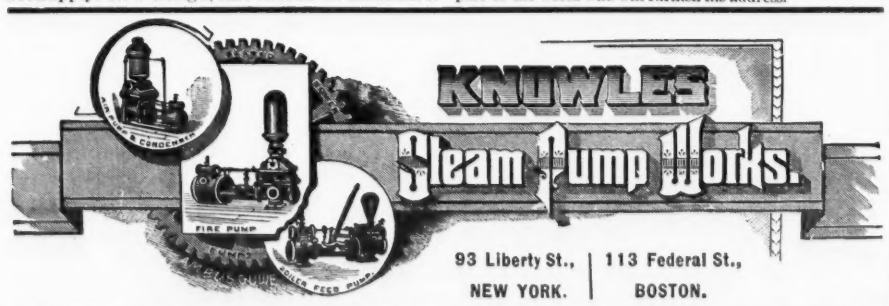

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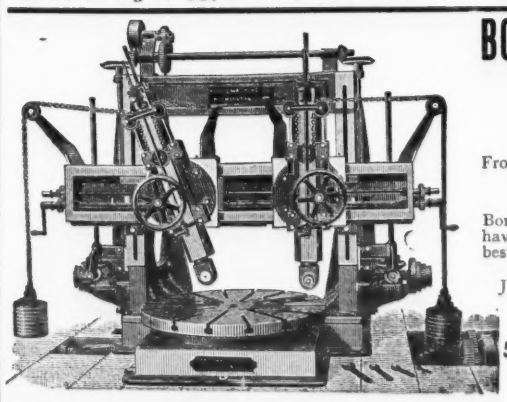

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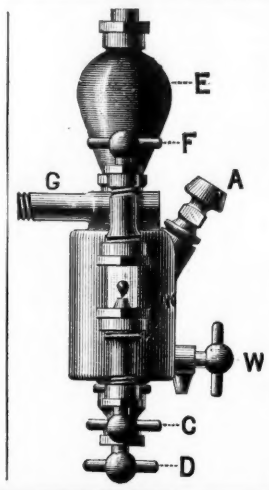

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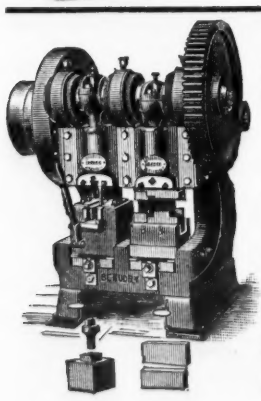

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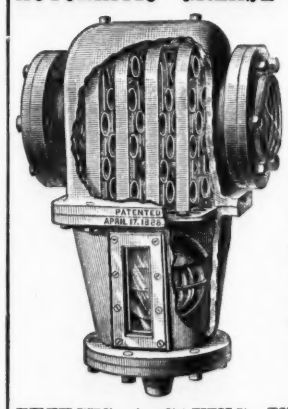

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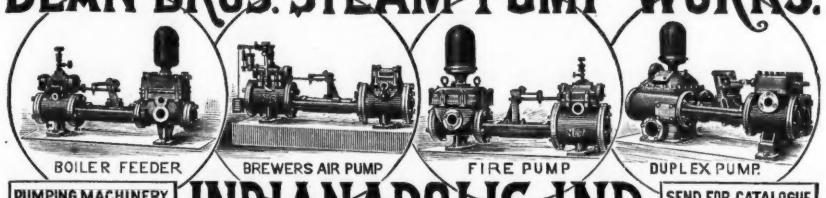

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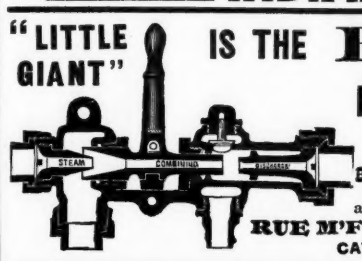

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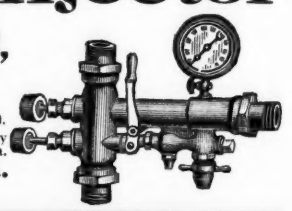

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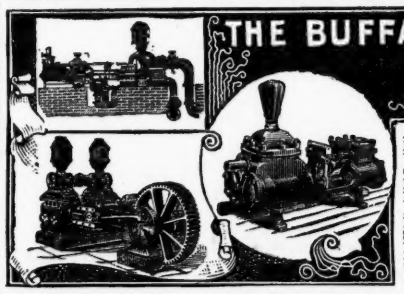

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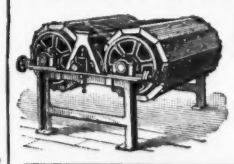

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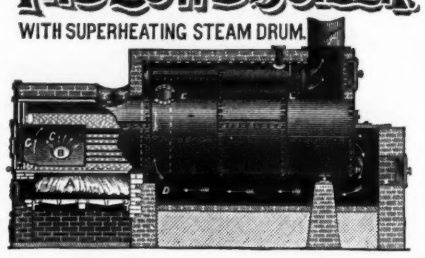

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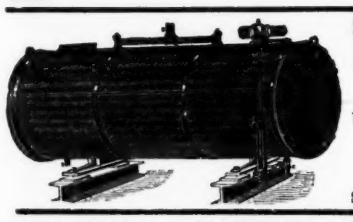

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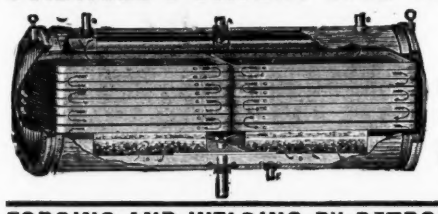

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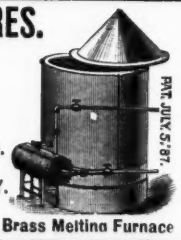

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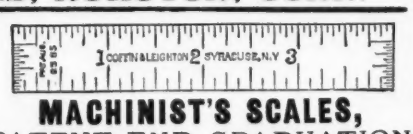

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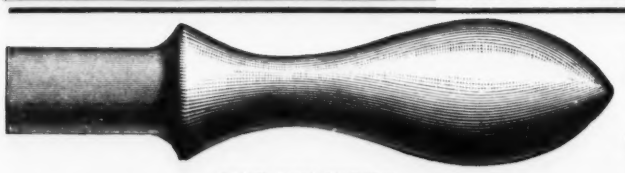

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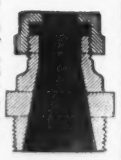

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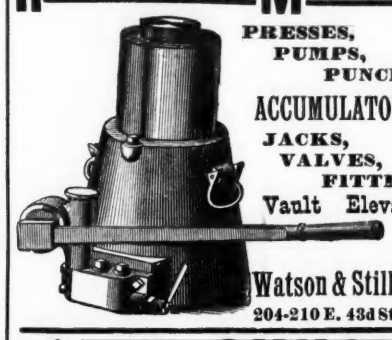

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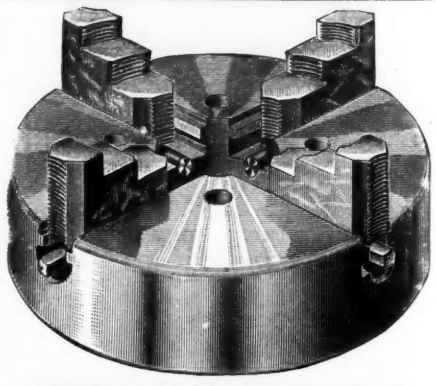

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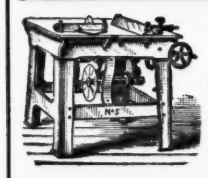

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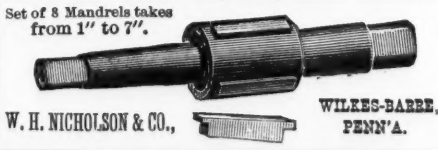

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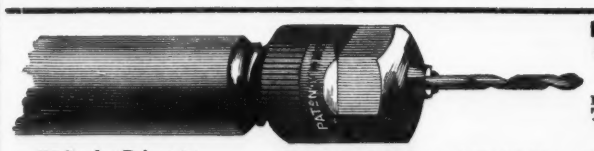

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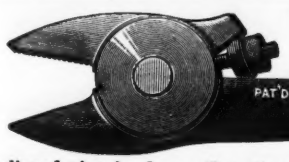

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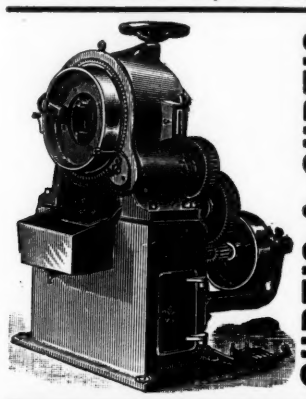

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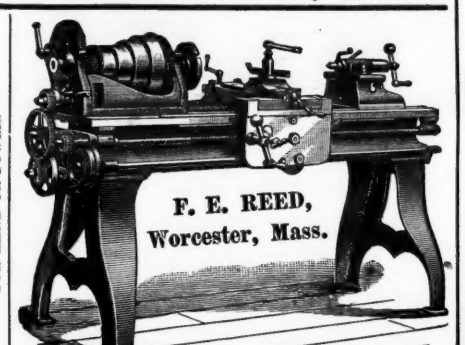

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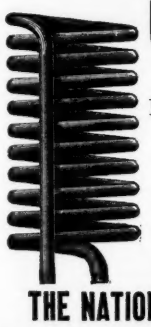

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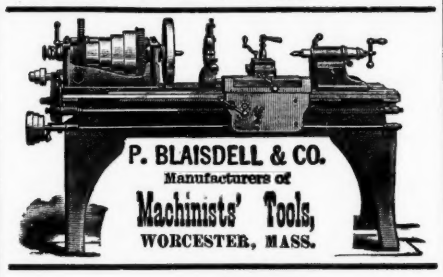

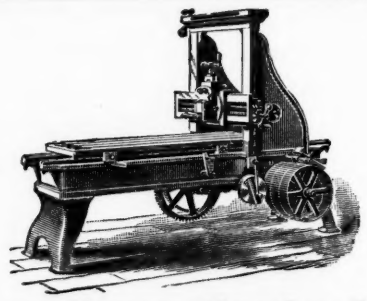

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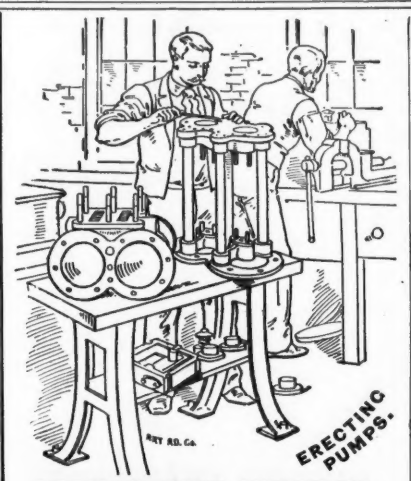

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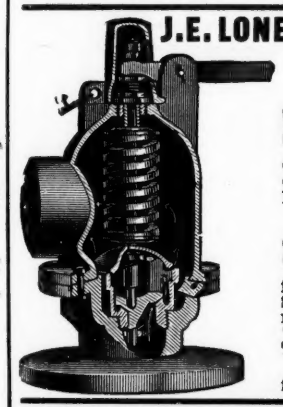

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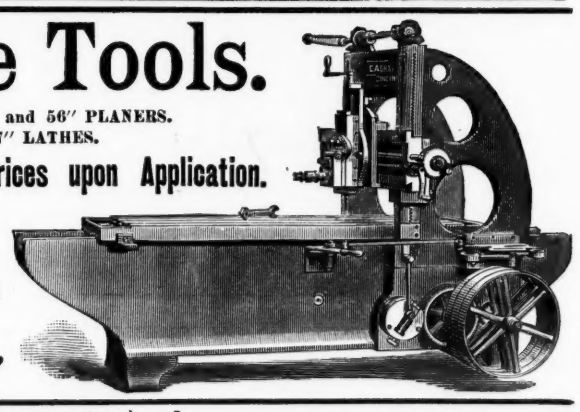

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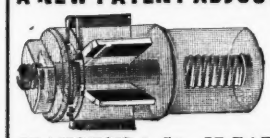

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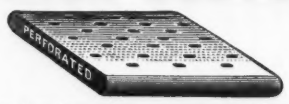

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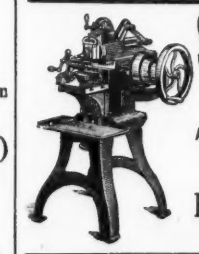

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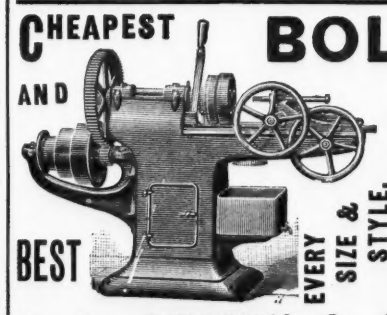

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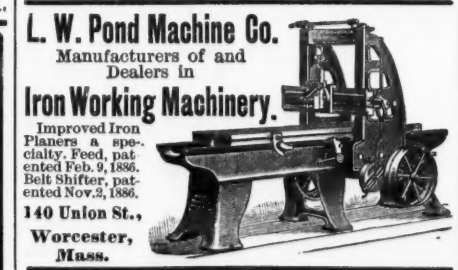

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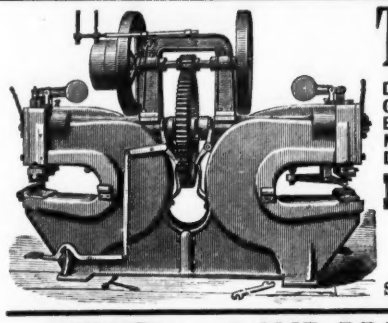

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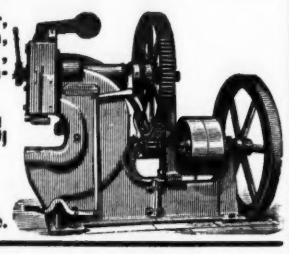

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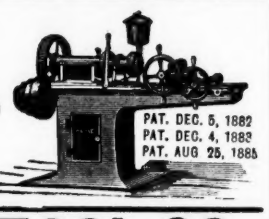

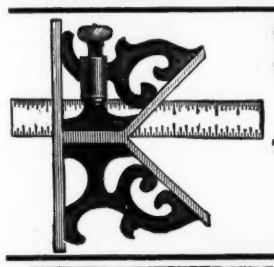

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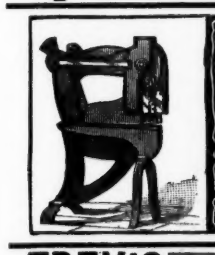

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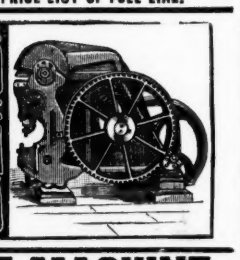

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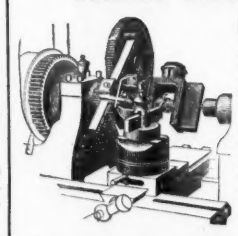

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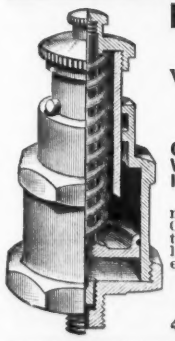

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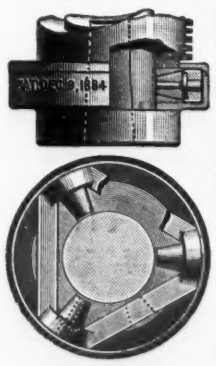

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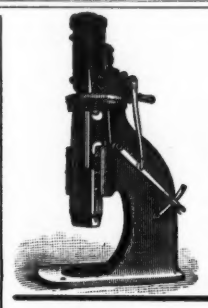

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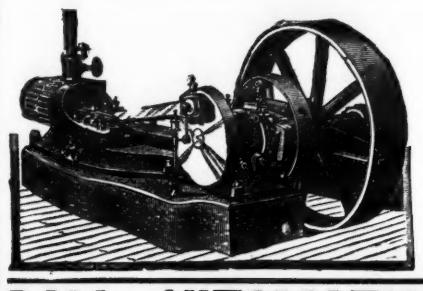

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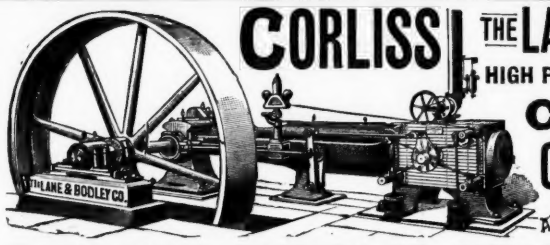

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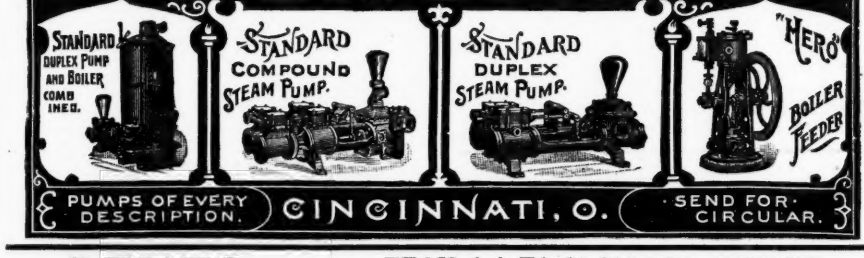

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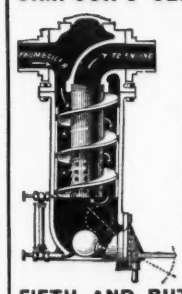

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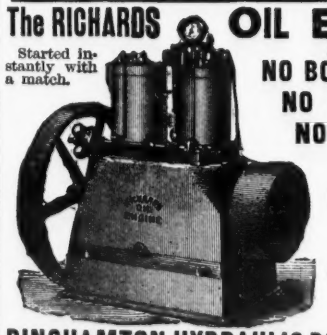

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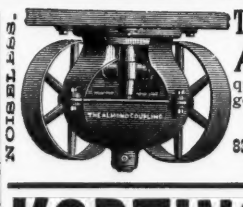

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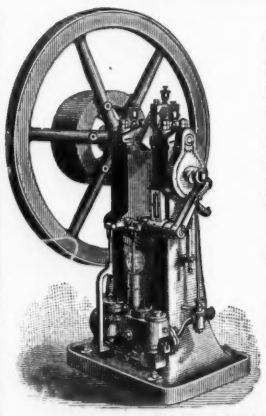

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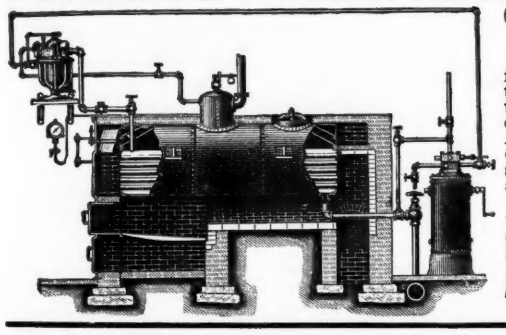

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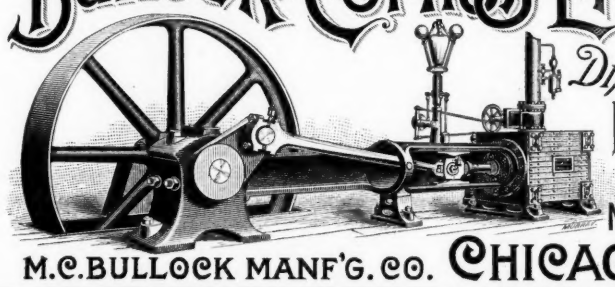

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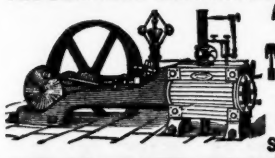

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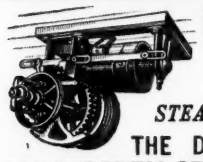

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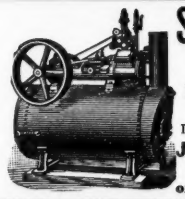

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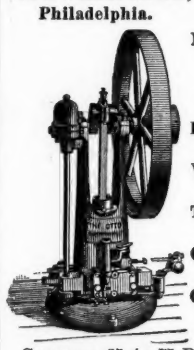

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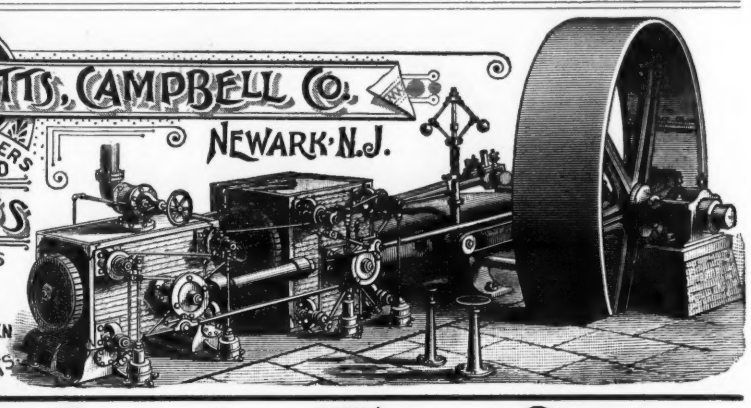

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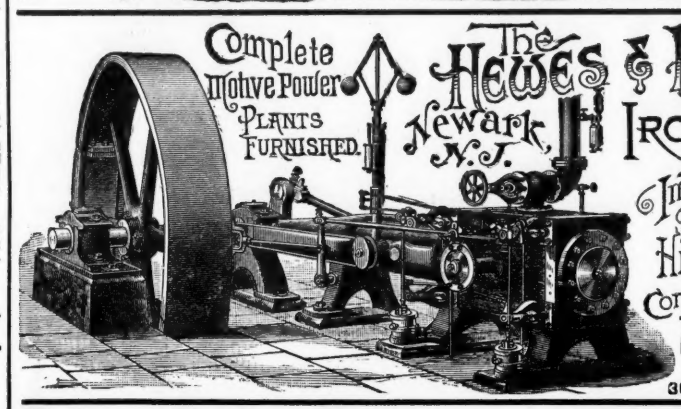

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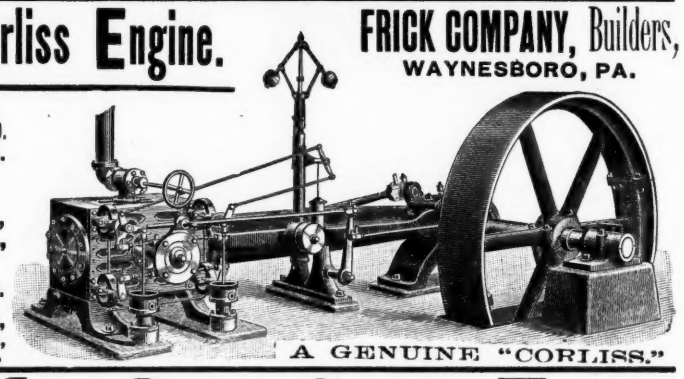

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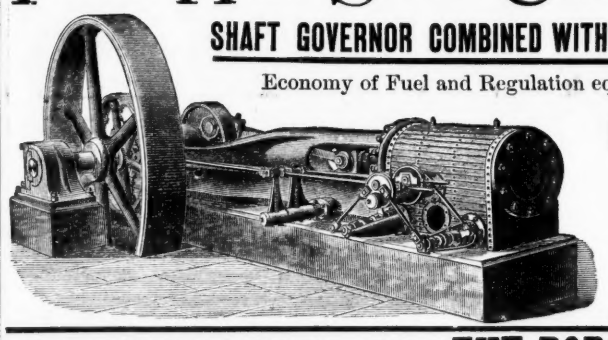

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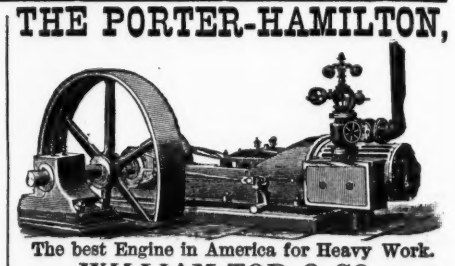

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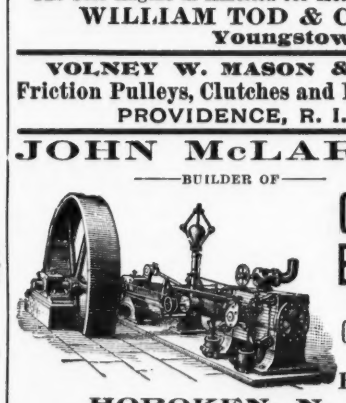

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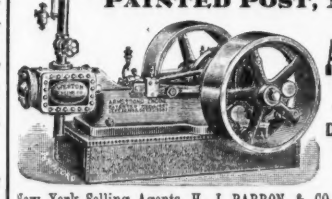

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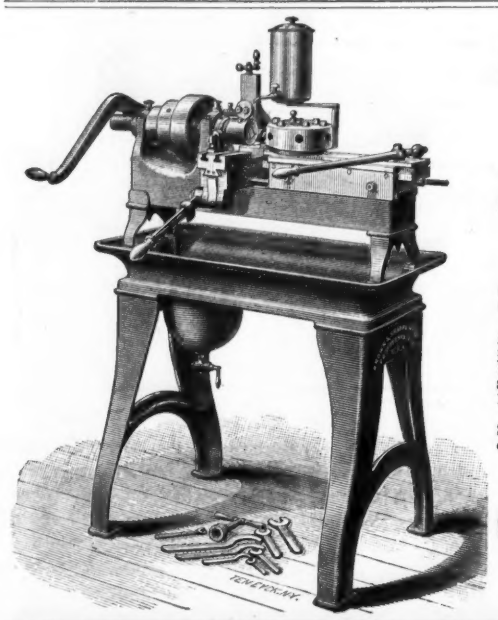

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In many instances this machine is used in stead of an Engine Lathe, and effects a saving of 25% to 50% in the cost of the work.

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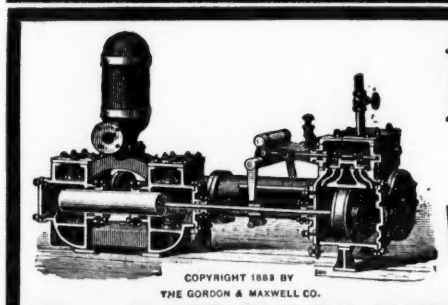

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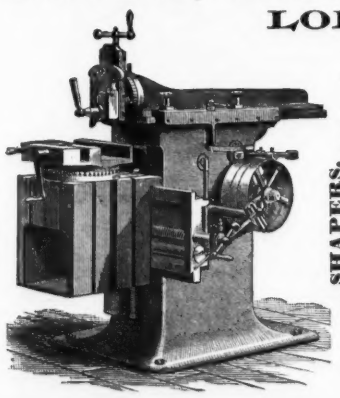

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20 inch Upright Drills.
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28, 32 and 40 inch Power Feed Drills.

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More **economical** than any we have ever used.
Can do **double** the work. Most convenient.
Best in the market. Much admired.
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Could not ask for anything better.
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We consider it a **model tool** and fills the whole bill.

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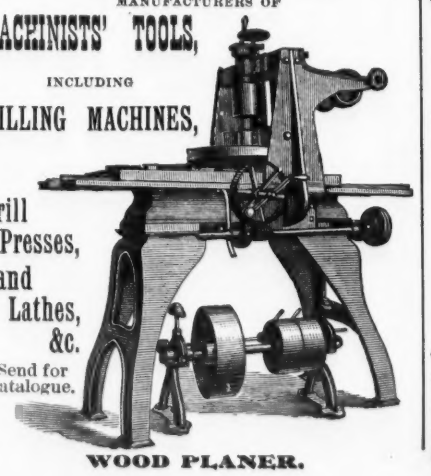

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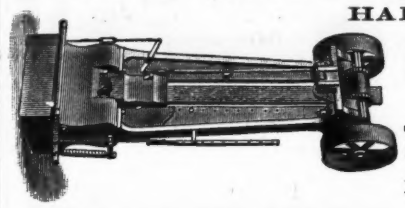

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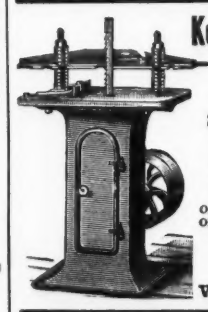

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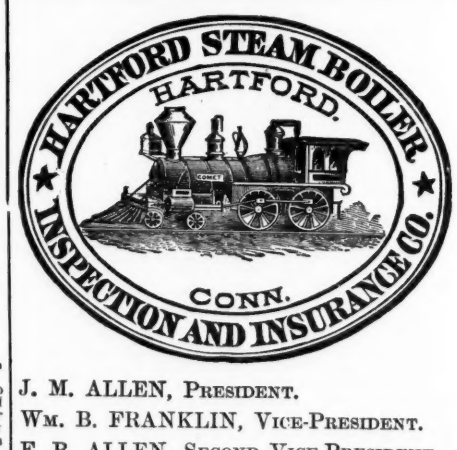

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